Curse of All The BBS Numbers

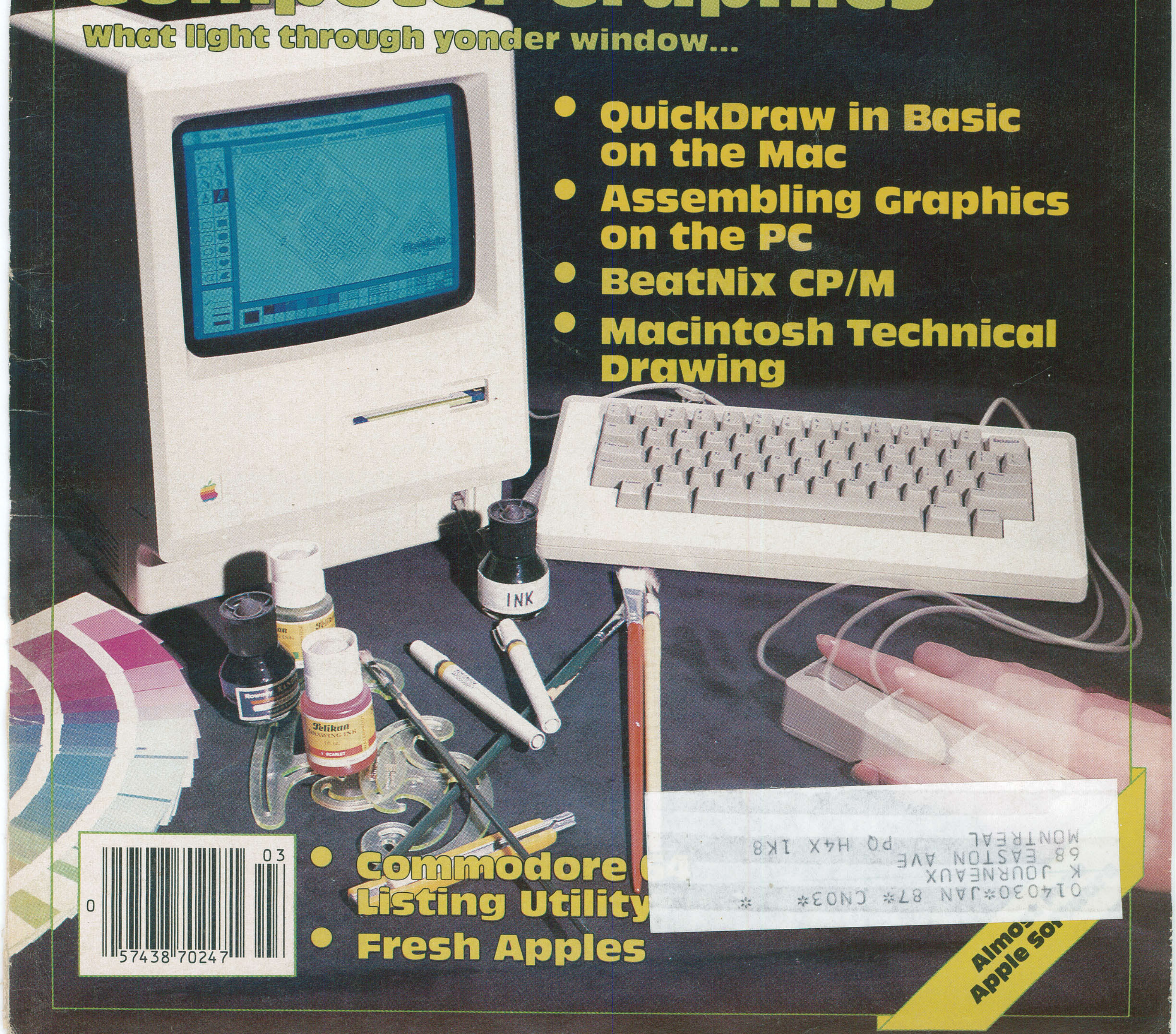
Computing Now!

Canada's Personal Computing Magazine
$3.25
MM70247
March 1985

Computer Graphics

What light through yonder window...

- QuickDraw in Basic on the Mac
- Assembling Graphics on the PC
- BeatNix CP/M
- Macintosh Technical Drawing



- Commodore C... Listing Utility
- Fresh Apples

Almo... Apple So...

0 57438 70247 03

014030*JAN 87* CN03* *
K JOURNEAUX
68 EASTON AVE
MONTREAL PQ H4X 1K8

The "BEST" Superb IBM PC & XT Compatibility

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Reviewed in March '84 Computing Now!

Loaded Best

Special Time — Limited Promotion

$1595

This price includes:

- 256K RAM (expandable to 1Meg.)
- Two slimline 360K DS, DD drives
- Colour video board. RGB and composite
- Floppy controller
- Serial port (RS232)
- High quality keyboard
- 150 watt power supply with fan
- 90 day warranty. (Extended warranty available at slightly higher price).
- 230V version available.

Note: Our system comes with the famous Phoenix Bios, currently used by several major computer manufacturers who claim excellent IBM compatibility.

Executive 10Meg BEST

- 10 Meg Hard Disk Drive and Controller and one DS,DD drive; everything else the same as the Loaded BEST described above. **$2595**

Tape drive (for back-up) option now available.

OR Everything described above except with 512K of Memory on Board instead of 256K **$2995**

New **Super Loaded Best** **$1895**

Includes all features of the Loaded Best. But has 512K of on board Memory.

Please Note: Don't be put off by our spectacularly low price; this is due to the fact we do not deal with middlemen and our volume buying power of parts. All BESTs are manufactured in Canada to the highest quality standards using prime, guaranteed components by our sister company. All systems pretested (burnt-in) for about 48 hours before shipping. Hundreds of happy customers report excellent reliability and compatibility.

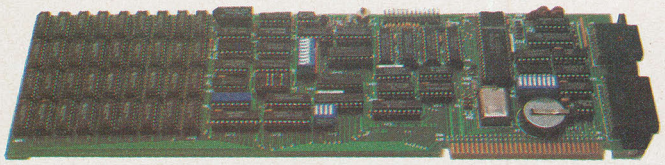
8 Slot Expansion System $499. For your IBM (PC, XT) Computer or Compatible (For details check catalogue)

(Comes with a Power Supply, Fan ventillation, attractive Housing (same as Best Computer) and a Host Adapter which plugs into your main system and three feet of Ribbon Cable with connectors.

Advantages: • Gives you an extra 8 Buffered Slots • Allows you to convert a PC into a 10 Meg Hard Drive System with lots of Memory and Tape Drive • Allows you to add drives to your system. • Lets your main system run cooler with less load.

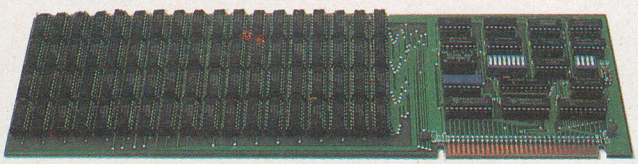
8 Slot expansion with 10 Meg Hard Drive, ready to go **$1495** 8 Slot expansion with 10 Meg Hard Drive and extra memory or other combination **$Call**

The Best 256K PENTARAM BEST SELLER



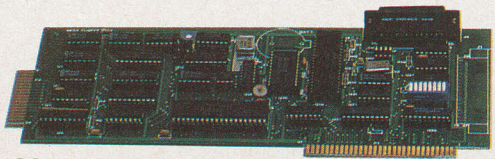
$399.00 with 256K RAM, Real Time Clock Parallel, Serial and Game Port (512K now available)

BEST 512K RAM BOARD



$495.00 (with 512K). With 64K **$189.00**

FLOPPY CONTROLLER BOARD AND OPTIONS

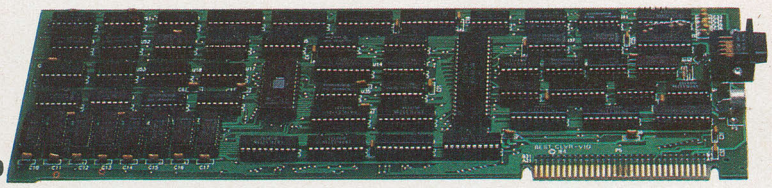


$129.00 With Real Time Clock and Serial Port only **$189.00**

EPROM Programmer **$99.00** (with ZIF Socket Adapter)

$159.00 Parallel/Game Port **$79.00** (cables Extra)

Colour Graphics Video Board



$179.00 (Composite and RGB Output)

Quantity, Students and Teacher discount's available.

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Star Micronics Gemini 10X 1 year warranty

• 120 c.p.s., • 816 characters print buffer, option 4K or 8K • standard parallel optional RS232C • tractor & friction feed. **$359.00**

Gemini 15X **$599.00**
Same as Gemini 10X. • 15.5" carriage

POWER TYPE LETTER QUALITY $639.00

• 18 CPS bidirectional logic seeking.
• 96 Petal Wheel

EPSON FX 80 ..... **$645.00**
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Multiflex parallel Interface for Apple or IBM ..... **$ 69.00**

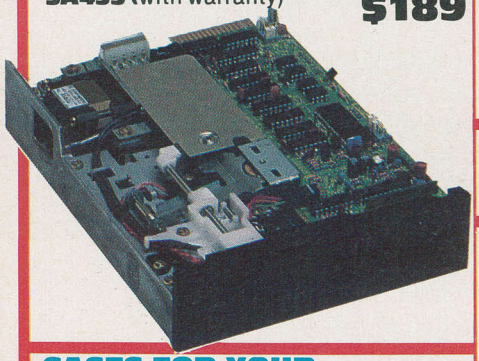
IBM COMPATIBLE KEYBOARDS

Cherry **$135.00**
Maxiswitch **$135.00**

Super Special
Keytronics Programmable Keyboard (no case) $69.00

IBM Compatible Disk Drive

SA455 (with warranty) **$189**



CASES FOR YOUR IBM Compatibles

• Hinged top cases allowing easy access by opening top half of the case. Can be supplied with plain back or for 5 or 8 slots. Please specify when ordering. **$74.95**

• Above case with power supply and fan
For Apple compatible 75 Watt **$169.00**
For IBM compatible 150 Watt **$219.00**

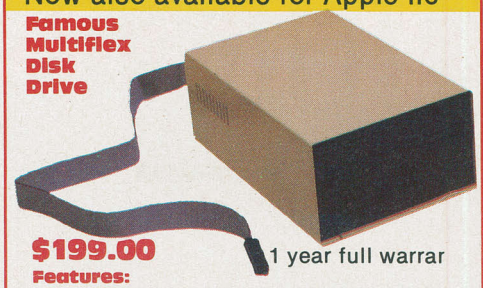
Hinged Case with 90W (max.) Power Supply with fan **$178.00**

As above with 175W (max.) Power Supply and fan **$228.00**

APPLE COMPATIBLE DISK DRIVES

Now also available for Apple IIc

Famous Multiflex Disk Drive



$199.00 1 year full warrar

Features:
• Apple compatible • Attractively packaged • Professionally built and tested • Canadian Made. We believe that Multiflex put out more drives in the last year than all other Canadian manufacturers combined.

Note: For $179 we offer 120 day warranty. However for 10% more get a full 1 year warranty.

Monitors

Zenith Data Systems

BEST SELLER ZVM 122A • 12" diagonal screen • non-glare amber display • composite input • 25 lines x 40/80 characters **$139.00**

BEST SELLER ZVM 123A • 12" diagonal screen • non-glare green display • composite input • 25 lines x 40/80 characters **$129.00**

ZVM 133 • 13" diagonal screen • RGB input • 25 lines x 80 characters • 640 x 240 pixels green screen only switch • 16 colours including PC brown **$799.00**

Spectacular Pricing on Apple Products — Call for best price

Peripherals for your Apple:

Z80 ..... **$ 49.00**
80 x 24 Video Card with Soft Switch ..... **$ 69.00**
16K RAM Card ..... **$ 49.00**
128K RAM Card **$159.00**
Parallel Card with Cable ... **$ 65.00**
Serial Card ..... **$ 69.00**
Apple Programmer ..... **$ 65.00**

BEST IBM Compatible Modem

• Plugs into motherboard
• Excellent Hayes compatibility
• Auto Dial, Auto Answer, Direct-connect

300 Baud **$179** 300/1200 Baud **$379**

300 BAUD MODEM for your APPLE $79.00

Auto Answer, Dial, Direct, Con. Plugs right into your Apple, comes with software.

Multiplex 300 Baud Modem

For your Apple (Super compatibility) **$159.00**

Hard Disk Drive

Seagate (industry favoured) 10 MEG. slimline **$895.00**
10 MEG Seagate, slimline drive and hard disk controller. This controller can handle up to two 10 MEG had drives.

Lowest Price of $1,159.00
Cable extra **$38.00**
Quantity Discounts Available

MEMORIES, At prices you can't forget! All prime stock and we guarantee the best price.

4116 150 or 200ns	$ 1.29
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Sets of 9	$32.95
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2716 450ns	$ 4.99
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2732 350ns	$ 6.99
2764 300ns	$ 8.95
27128 300ns	$19.95

Special Parts for your IBM & Apple Compatibles

Intel Parts

8087	$199.00
8088	$14.95
8237A-5	$14.95
8250	$11.50
8253A-5	$ 7.69
8255A-5	$ 6.99
8259A	$ 6.95
8284A	$ 7.75
8288	$15.95
NEC765/8272 Equiv.	$14.95
74CS322	$ 6.95
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5 Pin Din Connector	$ 1.29
100ns Delay Line	$ 6.50
6502 CPU	$ 5.99
Z80A CPU	$ 4.99
68A45 CRT cont.	$10.79
TMS99532 FSK Modem	$19.95
Set of 8088, 8255A-5, 8237A-5, 8288, 8284, 8253A-5, 8259A	$73.00

All Parts in our new 24 page catalogue except Memories and other parts which are advertised on this page are 10% Off, for any student bulk order discounts, can be arranged!

Circle No. 6 on Reader Service Card

Concorde Breaks the Price Barrier

A 45 cps Daisy Wheel Printer ***$1495.00*** *Suggested Retail*

The CI Concorde 1100 Printer comes by its name honestly. Its features soar above the competition, while its price stays at ground level.

Beneath a sleek exterior is tucked a simplified mechanism that powers one of the fastest printers around (45 cps). The Concorde 1100 is designed to handle all printing "whisper" quiet (60 dbA) on a generous 13.2-inch printline. It will tackle spreadsheets and graphics as easily as it will all correspondence.

And, first class extras come standard. The popular 96 character print wheel allows access to a wide variety of fonts and pitch sizes, while the print ribbon cartridge is clean and easy to change. Models available include Diablo*and Qume* emulations with a choice of Centronics, RS-232 or Qume interfaces. The Concorde's internal buffer is expandable to a full 40K so that lengthy print runs don't tie up the computer. Concorde also comes with friction platen and serial or parallel interface. For specialized uses, options include cut-sheet feeder and paper tractor.

For performance without the high price tag, fly with the Concorde.

TORONTO: 55 Torbay Road, Unit #2
Markham, Ontario L3R 1G7
(416) 477-0828
HEAD OFFICE: 17507-107 Avenue
Edmonton, Alberta T5S 1E5
(403) 489-8400 Telex: 037-42881

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Circle No. 2 on Reader Service Card

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Vol. 2 No. 12
March 1985

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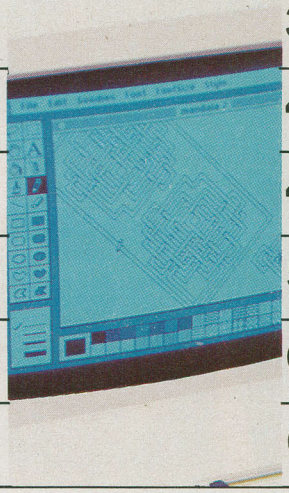

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SC110 a low power portable Oscilloscope

$480.00

Ultra low power consumption

The SC110 is based around a 2" diagonal CRT which requires extremely low power both in the heater and in the deflection circuits. This, combined with specially developed circuitry which automatically shuts down unwanted sections of the instruments, means that the SC110 can operate for very long periods on low cost disposable batteries as well as rechargeables. In the standby mode, power drain is typically 350 milliwatts.

Superb Ergonomic design

The SC110 has a similar front panel layout to a high cost bench oscilloscope. Timebase speed and Y-sensitivity are set by simple, clear, rotary switches. Function and trigger controls are positive, unambiguous push-buttons. The screen graticule is divided into 5 x 4 divisions, and the trace is bright and sharp.

A light, slim but tough package

The weight of the SC110 has been kept to a minimum. Even with the heaviest disposable batteries fitted it weighs under 2½ lbs. Despite the clear and easy to operate controls, the size has also been minimized and the complete oscilloscope is under 2 inches thick. The result is an instrument that can be taken anywhere, slips unobtrusively into a briefcase or toolkit, can be held in one hand, or operated whilst slung around the neck, in the optional carrying case.

Specifications:

DISPLAY, 32 x 36 mm blue-white, medium persistence, 5 horizontal x 4 vertical divisions. Adjustments: intensity, focus, trace rotate.

VERTICAL DEFLECTION (Y input). 10mv/div to 50V/div in 12 ranges. Bandwidth D.C. to 10 MHz 3 db at 1 div. 1 Megohm input impedance. Maximum input 350V (DC & A.C. peak)

HORIZONTAL DEFLECTION (X input) — switch selectable. 0.5V/division sensitivity, Bandwidth D.C. to 2 MHz 6 db. Maximum input 2.5V, protected to 250V rms.

TIMEBASE — switch selectable. Sweep times, 0.1 uS to 0.5 secs/division in 21 ranges. Calibrational accuracy 3%.

TRIGGERING CIRCUIT. Internal or external switchable. Coupling, A.C., D.C. T.V. frame, or T.V. line.

Full-sized performance

The SC110 has a 10MHz bandwidth and sensitivity down to 10mV per division. Full trigger facilities are provided, including Bright Line and Auto with TV Line and Frame filtering.

SC-110 ACCESSORIES:	
CARRING CASE	$27.95
A.C. ADAPTOR	$16.95
DUAL PROBE (X1-X10)	$39.95

thandar

TEST INSTRUMENTS

MODEL TM354 PORTABLE MULTIMETER

SAVE $21.00

$99.95

FORMERLY SOLD FOR $121.00

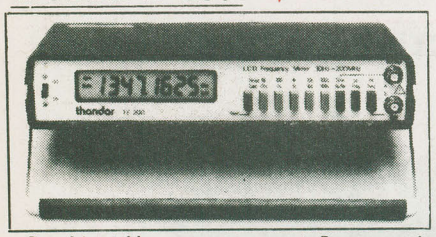
★ Pocket size ★ 14 ranges
★ 3½ digit 0·5" LCD ★ Battery life >2000 hours

Measurement capability:

DC volts	:	1mV to 1000V
AC volts	:	1V to 500V AC rms
DC current	:	1μA to 2A
Resistance	:	1Ω to 2MΩ

Accuracy: The quoted accuracy specifications are for the temperature range 18°C – 28°C and are maintained for typically 1 year. For temperatures in the range 5°C – 18°C and 28° – 40°C the accuracy specification is typically degraded by <0·1 × the applicable accuracy specification per °C.
Display: 3½ digit 0·5" LCD with polarity and overrange indication.
Overrange Indication: '1' shows in MSD, with all other digits suppressed.
Maximum Common Mode Voltage: 500V DC or AC peak.
Power Requirements: One 9V alkaline or zinc carbon battery.
Battery Life: Typically >2000 hours from a 9V alkaline battery such as Mallory MN1604

MODEL TF 200 $485.00



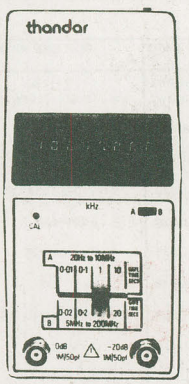
★ Bench/portable
★ 8-digit Liquid Crystal Display
★ Frequency range 10Hz – 200MHz
★ Resolution better than 1ppm
★ Sensitivity typically 10mV rms
★ Timebase accuracy 0.3ppm
★ Battery life 200 hours
★ Frequency, time average period, totalize & reset; 2 ranges, 5 gate times; external clock facility
★ Complete with batteries
★ GATE TIME .01 — 100 SECONDS IN 5 STEPS
★ RESOLUTION 1HZ — 1KHZ
★ ACCURACY WITHIN 1 COUNT

THANDAR FREQUENCY COUNTERS

MODEL PFM 200A

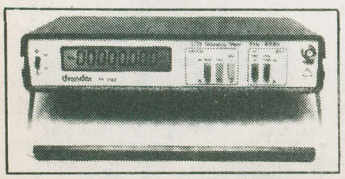
★ Timebase accuracy 2ppm
★ Pocket Size
★ 8-digit L.E.D. Display
★ Frequency range 20Hz – 200MHz
★ Resolution 0·1Hz
★ Sensitivity typically 10mV rms

$210.00



MODEL TF-040

10Hz to 40MHz $340.00

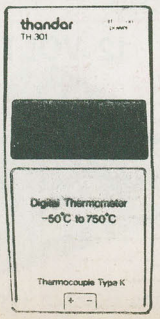


* ACCURACY WITHIN 1 COUNT
★ Bench/portable
★ 8-digit Liquid Crystal Display
★ Frequency range 10Hz – 40MHz
★ Resolution 1Hz
★ Sensitivity 40mV rms
★ Timebase accuracy 0·5ppm
★ Battery life 80 hours
★ Frequency, totalize & reset; 2 gate times
★ Complete with batteries
★ GATE TIMES — .2 and 2 SEC

PRESCALERS FOR FREQ. COUNTERS

TP600 600 MHz . $139.00
TP1000 1GHz . . . 185.00

MODEL TH301 DIGITAL THERMOMETER

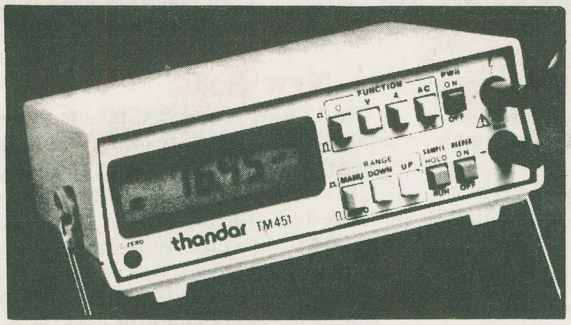


★ Pocket size
★ −50°C to 750°C range $180.00
★ 1°C resolution
★ 0·5" LCD ★ >1000 hour battery life

TH302 DIGITAL THERMOMETER $244.00
Pocket sized, measures from – 40 C to 1100 C. Both models supplied complete with naked bead thermocouple and batter. Accept any K type probe.

thandar test equipment

4½ DIGIT MULTIMETER



★ Bench/Portable
★ 4½ digit 0·4" LCD,
★ 0·03% basic accuracy
★ Full auto-ranging or manual
★ Sample hold
★ Audible continuity test
★ Complete with battery and test leads

$455.00 save $50.00

TM451 was ~~$495.00~~

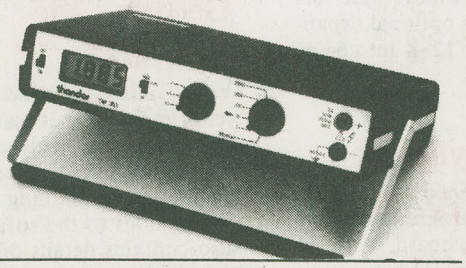
Accuracy:	Basic Accuracy ± (.01% of reading)
Battery Life:	70 hours from 9v Battery
Size:	155 x 120 x 57mm
Weight:	585 g. (including Battery)
DC and AC Volts:	200mV to 1000V
DC and AC Currents:	200mA to 1A
Resistance:	1 to 20M

3½ DIGIT METERS

LABORATORY ACCURACY
FOR BENCH OR ON THE GO

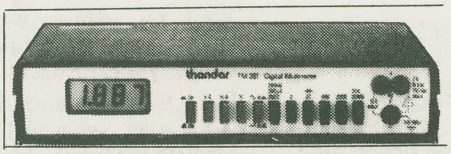
MODEL TM 356

$269.00



26 ranges
Battery life typically >3000 hours
Complete with batteries and test leads
★ Bench/Portable
★ 3½-digit 0·5" LCD
★ 0·25% basic accuracy

TM 351
$325.00



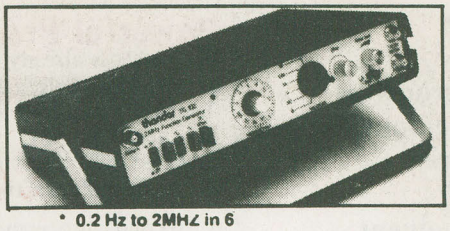
★ Bench/Portable
★ 3½-digit 0·5" LCD
★ 0·1% basic accuracy
★ 29 ranges
★ Battery life typically >2000 hours
★ Complete with batteries and test leads

SPECS MODEL TM 351 TM 356

	BASIC ACCURACY +- (0.1% 2000 HOURS	BASIC ACCURACY +- (0.25% 3000 HOURS
ACCURACY		
BATTERY LIFE		
SIZE	255 x 150 x 50mm	255 x 150 x 50mm
WEIGHT	1200g (Batteries included)	1200g (Batteries included)
DC VOLTS	200 mV to 1000 V	200 mV to 1000 V
AC VOLTS	200mV to 750 V	200mV to 750 V
DC current	200 uA to 10 A	200 uA to 2 A
AC current	200 ua to 10 A	200 ua to 2 A
RESISTANCE	200 to 20 M	2K to 20 M

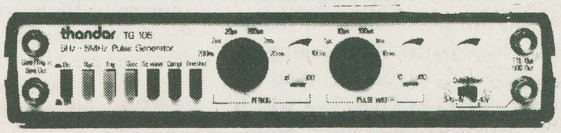
THANDAR GENERATORS

★ 0·2Hz to 2MHz Function Generator **$490.00** TG 102



- 0.2 Hz to 2MHz in 6 RANGES
- FINE Adjustment by calibrated VERNIER
- EXTERNAL SWEEP MODE
- SINEWAVE, TRIANGLE, SQUARE WAVE & DC OPERATING MODES
- VARIABLE 50 and TTL output
- MAXIMUM INPUT ± 10V
- 0.2Hx to 2MHz Function Generator
- Sine, Square Triangle Waveforms
- Variable DC offset
- Variable 50 output TTL output
- External Sweep Mode

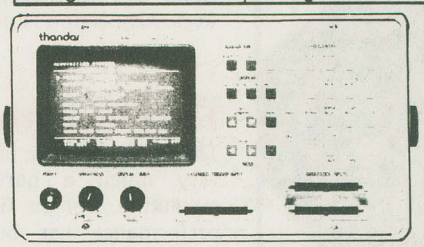
TG102 2MHz FUNCTION GENERATOR	
Frequency:	<0.2Hz to 2MHz
Functions:	Sine, Square, Triangle and DC from variable 50Ω output. External sweep: ≥1000:1 linear range.
Outputs:	60mV-20V from variable 50Ω output; variable DC offset to ±10V. TTL output.
Power Requirements:	120V or 240V AC (nominal) 50/60Hz
Size & Weight:	255 × 150 × 50mm : 1200gms



TG 105 Pulse Generator $335.00

★ 5Hz to 5MHz Pulse Generator
★ Free-Run, Gated or Triggered Modes
★ Squarewave, Complement
★ Variable 50Ω output
★ TTL output
★ Sync output

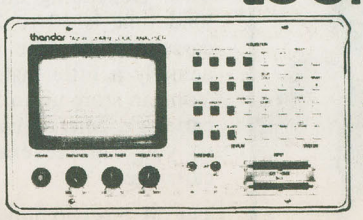
TG105 5MHz PULSE GENERATOR	
Period:	200nsec to 200ms (5MHz to 5Hz)
Pulse Width:	100nsec to 100ms, independent of period.
Operating Modes:	Run, Triggered, Gated, One Shot, Square Wave and Complement
Outputs:	0.1V to 10V variable 50Ω output; Separate TTL output; Sync. output
Power Requirements:	120V or 240V AC (nominal) 50/60Hz
Size:	255 × 150 × 50mm
Weight:	1200gms



New Lower Prices
Thandar
Logic Analyzers
from $3995
Call or write
for details

TA2160

LOGIC ANALYSERS



- TA2080 8 channel 20MHz logic analyser; timing and state display; 23 bit triggering; 252 word memory.
- TA2160 16 channel 20MHz logic analyser; timing and state display; 34-bit 2 level triggering; 252 word memory; RS232 interface.
- TA232P serial pod for data capture on asynchronous serial communication links.

TA2080

Gladstone Electronics, 1736 Avenue Road, Toronto, Ontario M5M 3Y7 Toll Free Order Line 1-800-268-3640

Sinclair QL

only $799.95 Including Professional Software

The most exciting new computer of the 1980's

State of the art hardware PLUS incredible software included at no extra cost!

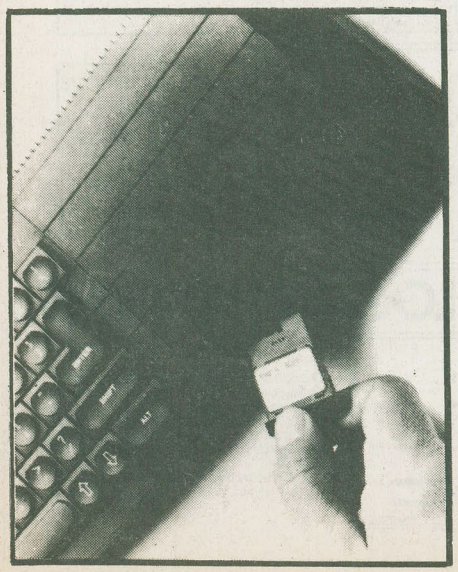
- **32-bit processor**
- **128K memory**
- **two built-in microdrives**
- **high resolution colour**

Includes software:
word-processing
database management
spreadsheet
graphics

The Sinclair QL revolutionizes the computer revolution. It offers the utmost in performance, speed and power at the remarkably low price of only $799.95.

The QL is a full-size computer designed around the most powerful and advanced microprocessor yet created for the personal computer: the Motorola 68008. With 128K RAM, expandable to 640K. Two built-in Microdrives. Networking. A full-sized QWERTY keyboard. And its own operation system — QDOS — which accomodates windows and even multi-tasking. High resolution colour or black and white display, on either monitor or TV. Two RS-232C serial interfaces. Joystick cursor control.

That's just the hardware. The QL also comes with all the software you need to get started right away doing useful work. Word processing. Spreadsheet. Graphics. Database management. A powerful set of programs as sophisticated and as easy to use as any on the market.



Powerful Processors

The 68008 is already the favourite choice of software designers for its speed and flexibility. Its 32-bit architecture virtually gurantees the QL will never become outdated, and that wide software choices will be available in the future.

A second processor, an Intel 8049, controls the keyboard, generates the sound, and acts as an RS-232 receiver.

New Operating System

QDOS resides within the QL's 32K ROM. It is a single-user multi-tasking, time-sliced system using Sinclair SuperBASIC as a command language. Multi-tasking allows you to run several programmes individually and simultaneously, a feature normally found on computers costing at least 10 times as much as the QL.

128K Memory Expandable

The QL comes with a generous 128K of internal RAM, more than enough for the largest programmes you'll want under ordinary circumstances. An optional expansion board can turn your 128K into 640K simply and inexpensively.

Professional Keyboard

The QL keyboard is designed for fast, accurate input of data and programmes. It is a full-size QWERTY keyboard, with 64 keys, including shift keys, five function keys, and four separate cursor control keys. Key action is positive and precise.

The Microdrives

The QL's cartridge tape storage system is very much a part of the Sinclair revolution. For the first time floppy disk performance has been matched in a compact medium far less expensive to own. Depending on programme length, load time is 10 to 20 times faster than cassette. The rate of data transfer is actually a little faster than floppy disk. You can store up to 50 files, or 100K, per cartridge. Microdrive maintains an index so you can see exactly what's on any cartridge.

The QL has two built-in Microdrives, with expansion of up to six more.

A New Basic

The Sinclair SuperBASIC combines the familiarity of BASIC with a number of major developments which allows the QL's full power to be exploited. Procedure facility allows code to be written in clearly-defined blocks. Extendability allows new procedures to be added which will work in exactly the same way as the command procedure built into the ROM with which you're already familiar. Constant execution speed means SuperBASIC won't get slower as your programmes get larger. Instead, long programmes run much faster than with other Basics.

Incredible Extra Features

The QL features built-in networking capability for up to 64 QL computers. Set up local area networks of QL computers to swap information, ideas and programmes, shared over the network at 100K baud.

High resolution graphics? Up to 512 x 256 pixels (4 colour), 256 x 256 (8 colour). ROM expansion? The QL will accept an additional 32K ROM cartridge.

Getting the most from your QL

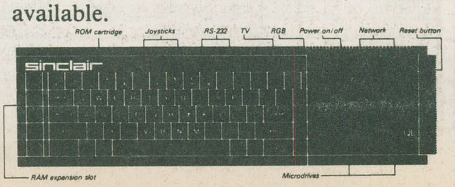
Your QL is supplied with a comprehensive set of manuals that make learning not only painless, but truly enjoyable. The QL manual includes a SuperBASIC reference manual, programming tutorial, and complete guides to the software. The manual also contains details of QL's comprehensive 90-day warranty, and service information.

Here is what you get:

Your QL comes with power supply, cables, manual, software and two blank microdrive cartridges.

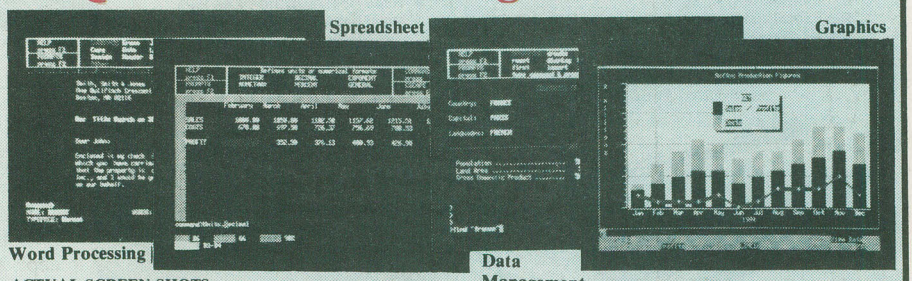
Free QLUB Membership. As a Canadian QL owner, you will automatically be enrolled in QLUB, and receive about four newsletters giving hardware and software hints, applications, plus information on new products for your QL.

Free SOFTWARE upgrades. enhancements to your QL software are likely. You will be automatically entitled to receive these upgrades as they become available.



The Sinclair revolution continues: 32-bit processor architecture, 128K RAM, QDOS operating system, bundled professional software, for serious home and business users.

QL Professional Integrated Software



ACTUAL SCREEN SHOTS

You would have to pay more than the price of the QL if you brought programmes of this calibre separately — we include them with your QL purchase! Integrated features include ability to transport data from one programme to another. Full use of colour, plus HELP screens make these programmes indispensable for home/business users.

Word-processing

QL Quill word-processing gives an exact screen display of how your printed work will appear. Helpful prompts are available on-screen to step you through every word-processing task. Features include automatic word-wrap and paragraph indentation. Delete text by character, word, line or by block. Search and replace. Cut and paste, set tabs, margins, line spacing, headers and footers, view wide document. Combine data from other QL programmes. Boldface, superscript, subscripts, underline, hyphenate, overwrite. And more!

Spreadsheet

QL Abacus makes simultaneous calculations and "what if" model-construction easier than they have ever been. Refer to rows, columns, and cells by names, not just letters and numbers. Function keys can be assigned calculations with a single key-stroke. On screen prompts and Help menus simplify operations. You can link spreadsheets, use multiple windows, vary column width and justification of text. Scroll windows jointly or separately, horizontally or vertically. There are many more features!

Database management

QL Archive is an extremely sophisticated yet easy to use filing system using a language even simpler than BASIC. You can define relationships, extract data and reorganize it, do statistical and accounting calculations and more. Screen editor allows you to design your own screen and format reports. Procedure and programmes may be written and saved for repeated use. Choose from 84 command words for queries, cross-reference entries, and search any number of files. Easy-to-use since everything is performed within the framework of familiar information prompts and Help menus.

Graphics

Spectacular colour graphs are easy to create with single key-stroke commands. QL Easel does not require you to format display before entering data; it handles design and scaling automatically or under your control. There are nine graph styles. Text can be added or altered as simply as data. QL Easel can also manipulate and evaluate data using a series of command math functions and formulas.

QL Hardware Specifications

System Configuration

Basic system for **$799.95** includes two processors, two custom designed control chips, 128K main memory (expandable), operating system programming language, full-size 65-key QWERTY keyboard, twin-QL Microdrives (100K-byte capacity each with 3.5 seconds average access time four software programs on Microdrive cassette (word processing, spread sheet, database management, graphics), blank Microdrive cassettes power supply, connecting cables and adapters for TV, monitor and LAN

Hardware

RAM: 128K, expandable externally to 640K (32K dedicated for screen bit map)

ROM: 32K, contains Sinclair SuperBASIC and Sinclair QDOS operating system (expandable via ROM cartridge to 64K)

CPU: MOTOROLA 68008, running at 7.5MHz, for all principal functions (Architecturally the 68008 is a 32-bit processor with an 8-bit data bus. One megabyte of non-segmented address space is available.)

INTEL 8049, a second processor, controls keyboard, sound, RS-232C receive and real-time clock functions

Custom Chips: Four Sinclair-designed ICs. The first controls display and memory, the second controls the Microdrives, the real-time clock, local area network and RS-232C transmission, the third and fourth provide analog functions required by the Microdrives

Video: High-resolution graphics capability with color/monochrome monitor (or TV) in two modes, 512 x 256 pixels (4-color), 256 x 256 pixels (8-color).

Normal character display format up to 85 x 25 with choice of character sets available; TV format up to 40 to 60 columns depending on software

Power Supply: 120 volts at 60Hz, 9v DC at 1.8 amps, 15.6v AC at 0.2 amps from transformer unit (19 watts to computer)

Mechanical Specifications

Dimensions:	5 1/8"	x	1 3/4"	x	18 1/4"
	138 mm	x	46 mm	x	472 mm
Weight:	3.055 lbs. (1388 gms.)				

Software

Operating System: QDOS, developed by Sinclair. Key features include
- single-user multiple tasking
- time-sliced priority job scheduler
- display handling for multiple screen windows
- device-independent input-output

Language: Sinclair SuperBASIC. Key features include
- procedure structuring
- extendability (including syntax)
- interpretation speed independent of program size
- clean machine code interface
- operating system facilities accessible from SuperBASIC
- equal capability for strings and arrays
- full-screen BASIC editor
- full error-handling facilities

Communications

Serial: Two standard RS-232C communications interfaces for printers, modems, etc. Transmission at rates from 75-19,200 baud or full-duplex transmit/receive at seven rates up to 9600 baud. (Note: a parallel printer interface is under development as an optional extra.)

LAN: For up to 64 Sinclair QL computers, data transmission over the net at 100K baud

Expansion

Excluding RGB monitor and power sockets and the TV port, nine peripheral/expansion ports are provided; internal expansion (1 port), Microdrive expansion (1), ROM cartridge (1), serial (2), local area network (LAN) (2), joysticks (2). For serial and LAN, see Communications

Internal: One megabyte of non-segmented address space is available for almost unlimited potential for expansion

Microdrive: Enables a further six QL Microdrives to be attached. Four blank cartridges are supplied with each QL

ROM Cartridge: Accepts one QL ROM cartridge up to 32K

Joysticks: Provision for one or two for games or cursor control

Gladstone Electronics, 1736 Avenue Road, Toronto, Ontario M5M 3Y7 Toll Free Order Line 1-800-268-3640

NEW

4 COLOUR PRINTER PLOTTER

Draws clear Hi-Res Graphics, Charts, and Text in 4 Selectable Colours

only

$249.95

model PL-1

Order Cosmic PL-1

as featured in ETI

- Connects to any computer with Centronics (parallel) interface
- Can be easily programmed for basic (complete operating manual supplied)
- Change colours instantly at any time
- Variable sized text, selectable from 1 to 80 columns!
- Can print in 4 directions (e.g. upside down, sideways, ect.)
- Includes 4 Long-Life colour plotting pens and 1 roll of paper (4" width)

Gladstone Electronics is proud to introduce a new standard in printer plotters. The fine resolution will amaze you. It can even print up to 80 columns in a small but easily readable type format. Print size is totally selectable in any number of characters per line, from 1 to 80. Uses standard paper (not thermal). The new PL-1 printer plotter from Gladstone Electronics. ETI loved it. You will too. Order today.

Set of 4 extra pens $9.95

STANDARD PARALLEL INTERFACES. If your computer does not have a Centronics output, this chart indicates what you will need to order: To use any printer on this page

COMPUTER	CENTRONICS INTERFACE MODEL:	PRICE
C-64/V20	Cardco G interface & cable	$129.95
2068 Timex	CI-2068 interface & cable	$169.95
ZX81/ TS1000	CI-1000 interface & cable	$159.00
Apple	or clone for II, II ±, IIe Pic card & cable	$124.95
Apple 2c	Model 1 Granny Smith & cable	$199.95
Macintosh	Model 2 Granny Smith & cable	$219.95

NEW

SMITH-CORONA FASTEXT-80 DOT MATRIX PRINTER

$399.95

Speed: 80 characters per second.
Friction feed standard
—optional tractor feed.
80 character print line at 10 CPI.
Full line buffer.
Centronics compatible parallel interface.
Graphics capability.
Fanfold or single sheets; (roll-optional).
Six pitches.

3 New Smith-Corona Dot-Matrix

$499.95 Model D100

TRACTOR AND FRICTION FEEDS 120 CPS

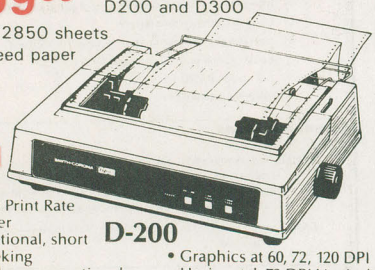
Gives you excellent data quality printing at 120 characters per second. Includes both friction feed and tractor feed, plus bi-directional printing, short line seek, and vertical and horizontal tabs. It has a full-line buffer, six pitches, graphics capability, and proportional spacing. Centronics® compatible parallel interface is standard. Serial is optional.

BONUS! Includes 2850 sheets tractor feed paper

$699.95 includes 2850 sheets tractor feed paper

Serial and parallel interface on D200 and D300

QL READY



D-200

- 120 CPS Print Rate
- 2K Buffer
- Bi-directional, short line seeking
- Six Pitches, proportional spacing
- Vertical and Horizontal tabs
- Nationwide Service network
- Graphics at 60, 72, 120 DPI Horizontal, 72 DPI Vertical
- Standard Tractor feed
- Built-in Dual Interface, parallel or serial

$899.95 D300

BONUS QL READY

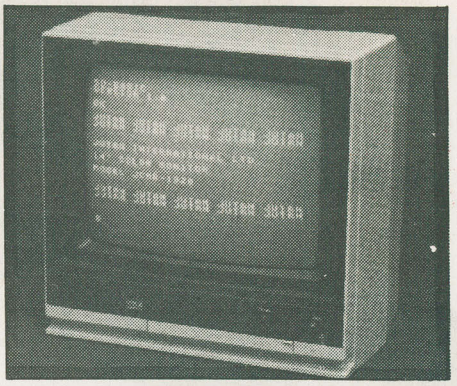
Price includes 2850 sheets 14" tractor feed paper Now 160 CPS.

Same specs as D200 but accepts paper up to 15" wide

Order toll free — have your credit card ready
1-800-268-3640 (to place orders only)
Product Information (416) 787-1448

14" Colour Monitor $515.00

RGB/Composite Video Inputs



$499.95 Also works great for VCR !

QL READY

JCMR 1920 3 or more @ **$499.95**

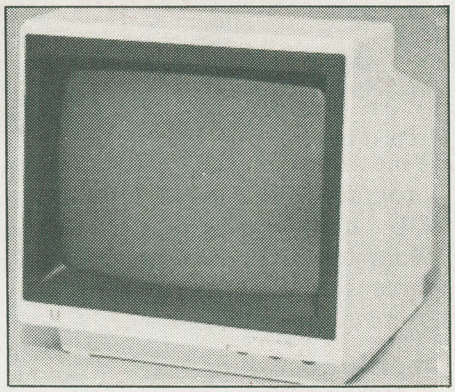
JIL 14" Colour Display Monitor

- Designed for both computer and television reception
- RGB/NTSC composite and separated video: compatible with virtually all personal computers
- Total 2000 characters (80 x 25 lines, 5 x 7 dots)
- Colour display, Composite Video – all colour RGB: 16 colours
- Individual function control in the front
- Built-in front speaker for audio
- Medium resolution quality
- Video input level: 1.0 - 1.25 Vp-p
- Video bandwith: RGB: 18 MHZ

RGB AND COMPOSITE VIDEO INPUT

Dimensions: 356 x 363 x 385 mm (H x W x D)
Gross Weight: 10.91 kg

12" Monochrome Monitor



JIL – Green or Amber $149.95

- Desined for business or personal computers
- Total 2000 characters (80 x 25 lines) (5 x 7 dot)
- Brightness and contrast control on front
- Green phosphor P31 display
- Composite video input
- Video Bandwith: 18 MHZ
- Video input level: 1.0 Vp - P
- RCA pin jack connector

Anti-glare screens eliminate eye fatigue!

Dimensions: 350 x 386 x 371 mm (W x H x D)
Gross Weight: 5.91 kg.

JMMR 1902 (same as above)

- Amber display

MONITOR STAND ONLY $29.95 4 for $99.95

Swivel Base for Video Display Monitors & TVs

" Lets you turn your monitor or TV to any position you like! Swivels a full 360° – features 12.5° up/down tilt adjustment.

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Introduction to SUPER BASIC on the QL	19.95
Advanced Programming for the Sinclair QL	19.95
Word Processing on the QL	19.95
Desk Top Computing with the QL	19.95
Profiting from the QL: QL Abacus	$24.95
Using Graphics on the QL: QL Easel	24.95
Database Management on the QL: QL Archive	24.95
Makeing the most of the QL: QL SUPER Basic and it's Applications	24.95
Machine Code Programming of the QL	24.95

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22396	Commodore 64 Trivia Data Base	12.95

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008909	(CSCS-1) Osborne OCC1, OCC1A Computer	55.95
008910	(CMT-2) Zenith ZVM-121 Panasonic CT 1350MG	25.50
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HARD TO FIND . . . UTILITY SOFTWARE

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Forth II	89.95
Listener	32.95
Screen Machine	39.95
Talker	32.95
BEAGLE BROTHERS	
Alpha Plot: Hi-Res Graphics Utility	52.95
Apple Mechanic: Shape Editor/Byte Zap	38.95
Apple Mechanic Type Faces: 26 Fonts	26.95
Beagle Basic: Applesoft Enhancer	45.95
Beagle Graphics: 128K Hi-Res	78.95
D Code: A'Soft De-Bugger	52.95
Diskquick: Apple 11e Disk Emulator	38.95
DOS Boss: Disk Command Editor	32.95
Double-Take: 2-way Schroll/List & Xref	45.95
Fatcat: Disk Library Disk	45.95
Flex Type: Hi-Res Text Utility	38.95
Frame Up: Apple Presentation Utility	38.95
GPLE: Global Program Line Editor	65.95
Pronto DOS: High Speed DOS & Mover	38.95
Tip Disk #1: 100 Tip Book Programs	26.95
Tip Disk #2: Silicon Salad	32.95
Triple Dump: Print Anything Utility	52.95
Utility City: 21 Utilities + Xlister	38.95
BRODERBUND	
Dazzle Draw 128K	78.95
Print Shop	65.95
Print Shop Graphics #1	32.95
CODEWRITER CORP.	
Menuwriter	72.95
DATASOFT	
Micropainter	39.95

(Apple II & IIe Continued)

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ORCA/M	117.95
HAYES	
Smartcom I (Apple 11, 11e	154.95
Terminal Pkg. (Apple & Smartmodems)	129.95
MICROLAB	
Lifesaver (Disk Utility)	34.95
Painter Power	54.95
MUSE	
Data Plot	77.95
U-Draw II	51.95
The Voice	51.95
PENGUIN SOFTWARE	
Cat Graphics 1-2/Res	44.95
Complete Graphics System	104.95
Complete Graphics - Additional Type Sets	25.95
Complete Graphics - Map Pack	25.95
Disk Arranger	38.95
Disk Repair Kit	38.95
Graphics Magician 1-2/Res	77.95
Graphics Magician Picture Painter 128K	77.95
UNITED SOFTWARE	
ASCII Express	169.95
ASCII Express 128K	169.95

APPLE MACINTOSH

HABA SYSTEMS	
Habacom	129.95
Window Dialer	64.95

COMMODORE 64 DISK

BRODERBUND	
Bank Street Writer	65.95
CONTINENTAL	
F.C.M. (Filing, Cataloging & Mailing)	64.95
Home Accountant	97.95
Home Cataloger	64.95

Note: All Apple programs listed also run on 11 C

COMMODORE 64 CARTRIDGE

HESWARE	
HES KIT 64	57.95
HES MON 64	57.95

COMMODORE 64 DISK

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Menuwriter (PC Only)	72.95
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COMPACT CB RADIO FOR TODAY'S CARS!

MAXCOM 20

only **$88.00**

SPECIFICATIONS

Unit Size: 1 3/4" (44mm) H x 6 5/16" (160mm) D x 4 3/4" (119mm) W
Accessories Included: 500 ohm push to talk microphone with coil cord and din connector. Microphone clip. Fused 3-pin DC power cord. Mounting bracket and hardware. Owners manual. Required FCC forms.
Frequency Control: Phase Locked Loop
Receiver Sensitivity: 0.7 uV for 10 db(S+N)/N
Receiver Selectivity: more than 55 db/10 KHz
Controls: On/off/volume. Variable Squelch. ANL off. CB/PA Switch. Channel selector with readout. Analog signal/RF power meter and transmit indicator.

- Super small, light weight unit allows flexible mounting in newer compacts and imports
- Wide variety of features include back-lighted analog signal/power meter preferred by many frequent users
- Automatic Noise Limiter (ANL) switches "on" to reduce atmospheric noise if present
- Large scale LED channel indicator and accurate Phase Locked Loop (PLL) tuner
- Public address amplifier is built-in—accepts 3.5mm optional PA speaker
- Clean, modern cosmetics blend with all auto interiors

Never before has a CB radio been available like Maxcom® 20 in a mini-size, with so many features, and at such a competitive price. The rugged cabinet incorporates all solid state circuit components resulting in extremely sensitive receiver, high level modulation, and full 4 watt output capability.

Variable squelch and switchable ANL circuits function to quiet receiver in standby mode and reduce atmospheric noise when present in receiver. For feature and performance, Maxcom® is the name to remember for communications products.

Rugged mobile C.B. antenna, base loaded, stainless steel for years of protection. Heavy duty no-hole trunk lip mount, lead-in coax wire, and connector to C.B. are included. Coil, spring, and whip are easily detachable for storage.

C.B. ANTENNA $29.95

FM Wireless Communications

Communicate with Gladstone's.

Model 495

only **$64.95** EACH

3 or more at $59.95 ea.

Operates on its own private liscenced channel

- Voice-actuated switching from transmit to receive
- Up to ½ mile range
- Light-weight portable — go anywhere
- Great for cycling, construction sites, film crews, factories, or anywhere you need to communicate!!

Model 49B — Same as 49S but includes protective carrying case and charger for ni-cad batteries. $84.95 each. Three or more at $79.95 each. Formerly sold at $119.95 each.

Note: Two or more units are required for communications.

FEATURES

TRANSMIT MESSAGES AUTOMATICALLY . . . Just speak into mic element on headset — Vox circuit activates by adjustable Hi-Med-Lo mic sensitivity switch. Eliminates false triggering caused by ambient noise in background.

VOX BYPASS . . . Switches unit to manual (PTT) mode; user presses PUSH-TO-TALK switch before transmitting.

ADJUSTABLE HEADSET: Comfort-fitting earpiece with foam cushion pad contains communications quality speaker element. Audio volume controlled by Hi-Med-Lo switch for listening preference. Efficient-Condenser mic element with protective wind screen on moveable boom. Whip antenna secures out of way when not in use.

EXCELLENT PERFORMANCE: FM transmitting range can effectively reach ¼ to ½ mile (with unobstructed line of sight and fresh battery); clean, noise-free reception thru crystal controlled dual conversion superheterodyne receiver.

VARIETY OF USES: SPORTS AND RECREATION — coaching, skating, racing, hiking, boating, fishing, camping; **BUSINESS** — warehousing, construction, loading and unloading, surveying, hospital use — hundreds of applications.

PORTABLE, CONVENIENCE — Rugged, yet light-weight cabinet has spring loaded clip on rear case for securing to belt or pocket. Measures just 4 9/16"(H) x 2½"(W) x 15/16" (D). Weighs less than 9 oz.(270g).

Portable-Mobile 40 Channel CB Transceiver

only **$109.95**

formerly sold for $124.95

2 or more @ $99.95 each

* Includes Eveready batteries

Model MX-7

* Full 5 watts * Mobile or portable

Maxon's Model Maxcom-7 CB transceiver takes the practical uses of CB communications and combines them with portability to make the most versatile system on the market. Maxcom-7 operates as a regular mobile CB or, with minor modifications, can quickly be changed to a portable. It's easy to use and comes complete with accessories (batteries optional). Maxcom-7 . . . A good idea made even better, by Maxon.

FULLY COMPATIBLE . . . Maxcom-7 operates on all 40 CB channels. Channel 9 is highlighted for quick visual reference.

COMPLETE CONTROLS . . . Power "on" / volume control lets user adjust audio output for comfortable listening. Rotary squelch silences receiver when no incoming signals are present. Large channel knob is easy to grip for changing stations.

EASY OPERATION . . . User just presses big Push-To-Talk bar and speaks into built-in mic. Transmit (TX) L.E.D. gives visual reinforcement that message is "Getting Out". Release Push-To-Talk bar to receive message.

CAR ANTENNA . . . Magnet mount base holds screw-in telescopic antenna . . . magnet holds base to metal surface on car such as roof or trunk lid. Lead wire from magnet base terminates in RCA plug which inserts into jack on bottom of radio.

PORTABLE ANTENNA . . . Telescopic antenna with threaded base removes from magnet mount . . . connects directly to threaded jack on top of radio.

TWO POWER CHOICES . . . Fused cigarette lighter adaptor with coaxial plug can supply power direct to unit from car electric system. The portable carry case is designed to accept 10 (Ten) 1.25 volt rechargeable nicad batteries. A "charge" jack is provided in the battery compartment for recharging nicad batteries. (Optional charger required. Regular 1.5 volt carbon-zinc batteries can be used to power the unit but these batteries **cannot** be recharged.)

STORAGE CASE . . . Protective vinyl clad case holds unit and all accessories . . . has carry handle and snap-lock cover. Stores under seat or in trunk.

Helmet Adaptable FM Two-way Radio With FM Broadcast Receiver and Rider to Passenger Intercom

Model 49-HI same as 49-HR but less FM Radio

$99.95

SPECIAL FEATURES

- New convertible headset has boom mic, earpiece that easily modifies for simple helmet installation.
- Intercom headset also provided for helmet use. In motorcycle applications, rider and passenger can talk with each other, listen to FM radio, as well as communicate back and forth with other two-way radios on the same frequency. Safety plus entertainment!
- Hands-free two-way radio can be voice operated (by the rider only) or operated manually by large safety-recessed push to talk button.

HUNDREDS OF APPLICATIONS!

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Auto Racing
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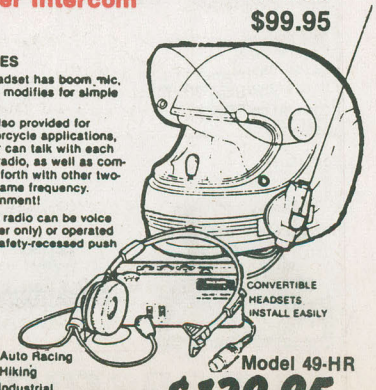

Model 49-HR

$129.95

Gladstone Electronics, 1736 Avenue Road, Toronto, Ontario M5M 3Y7 Product Information (416) 787-1448

Moorshead Publications Software Services

Stockboy Inventory Control Package

When we first advertised this program, we would have been pleased with a fraction of the orders we received. On reflection we should have appreciated what a bargain it is. Inventory programs are generally pretty expensive and some of them are inflexible and some even badly engineered. You may find that even small inventories generate enormous files.

Stockboy is a good, powerful, flexible bargain-priced package which will handle inventory for small businesses. We use Stockboy within Moorshead Publications for our own inventory control and it has stood the test of time.

Stockboy can:

- **Maintain an inventory database with current, maximum and minimum stock reporting when an item needs re-ordering.**
- **Be a point of sale terminal, adjusting the stock data base on line.**
- **Produce individual packing lists.**
- **Generate a customer list to be used in mass mailings.**
- **Run on any CP/M or MS-DOS based computer, even an Apple II running with a softcard.**

Stockboy is written in Microsoft BASIC, and is designed to be easily altered to suit your needs. It can be compiled using BASCOM if you desire. It is designed for use by non-technical operators.

Available for: CP/M and PC formats

$29.95 most systems **$34.95** for 8"

Ontario residents add 7% PST.

MDM730

MDM730 is one of the most powerful MODEM7 programs available . . . and the Computing Now! version of MDM730 incorporates features not available in the public domain editions. If you are into telecommunications, bulletin boards and downloading software your life will be full and meaningful with this code. For background on MDM730, see July 1984 Computing Now!. Consider the facilities.

- Terminal program which works at any baud rate.
- Ten programmable macro function keys.
- Thirty six number phone library.
- Christensen software transfer protocol.
- User settable toggles for line feeds, ON-XOFF and so on.
- Extensive help menus.
- Baud rate selection on the fly (or the spider).
- ASCII dump and capture.
- Status menu
- Many more features.

In addition to all this splendor, however, we've added dialing support for the Apple version. While the standard MDM730 cannot dial unless it's hooked to a Hayes Smartmodem, we've added patches to it to allow it to do pin twenty five pulse dialling and to dial through the Hayes Micromodem II and the SSM card. The Computing Now! MDM730 will also

- Select a number from the library and dial it
- Accept a hand entered number and dial it
- Wait for carrier
- Log you onto the remote system if it's free
- Optionally autodial if the remote board is busy.
- Count the number of attempts at dialling the remote BBS.

The Computing Now! MDM730 package is available for

- The Hayes Micromodem II.
- The SSM 300 Baud modem card.
- The PDA 232C serial card with external modem.

The PDA 232C package includes versions supporting both the Smartmodem and a dumb modem with pin twenty five line control, such as the Novation AutoCat.

Also included with each package are utilities to permit easy alteration of the phone number library and the function key macro strings plus an extensive documentation file.

The source code file for this program is over a hundred and fifty kilobytes long. It cannot be hacked on a standard Apple. We patched it on a larger machine and downloaded it. As such, we're pretty sure that MDM730 with these features is unavailable elsewhere.

Available for: Apple II + CP/M 2.2. systems

TRS-80 Model II (complete with the above applicable features)

Please specify modem version from above list. **$29.95**

Ontario residents add 7% PST.

Fine Print:
The original MDM730 code is in the public domain. We are offering this part of the program without cost. The charges for this package are for the patches created by Computing Now! and to defer the cost of handling and postage.

This software is guaranteed to work correctly if properly applied. The serial cards or Apple and compatible systems must be installed in slot two with at least 48K of RAM running Microsoft CP/M 2.2. The PDA 232C version will require the availability of either a Hayes Smart-Modem or a modem with pin twenty five line control to dial. Users of the SSM card version may experience some difficulty in detecting extremely faint carriers on older versions of this card.

Formats

Where **CP/M** is shown, the following formats are available:

Apple II + CP/M (see below)
Access Matrix, Morrow Micro Decision, Superbrain, Xerox/Cromenco*, Epson QX-10VD, Sanyo MBC1000, Nelma Persona, Kaypro II, Osborne Single Density*, Osborne Double Density, Televideo, DEC VT-180, Casio FP-100, Zorba, 8 inch SSSD*

*Software marked with an asterisk is the higher price quoted.

MDM730 for the Apple II + CP/M requires two disks and is at the higher price.

PC
Available for the IBM PC and genuine compatibles.

AppleDOS
For Apple II + and genuine compatible systems.

TRS-80 Model II CP/M
Will operate under either Lifeboat or Pickles and Trout CP/M.

Apple Wordstar Fixer

Apples and Wordstar are not entirely friendly. Apple compatible systems equipped with Videx type eighty-column cards do a number of unpleasant things to this popular word processor. While there are simple cures for this... they all involve some delicate code hacking.

The Fixer solves this problem. Place it on the same disk as your copy of WS.COM, type FIXER and after a suitable amount of disk noise version 3.0, you will have APWS.COM on there too. This version of Wordstar includes special patching and unhooking code which runs each time you boot Wordstar, and makes your fruit behave as it should. It releases the control K's, translates the left arrow key to a delete character, and patches Unitron keyboards.

In additional all of this, the fixer allows you to set some of the defaults of Wordstar which the MicroPro INSTALL Package doesn't really get to. All of these features are menu driven in English for absolute non-technical operation.

Fixed Wordstar will run in either 44K or 56K CP/M.

Available for:
Apple II + CP/M only. **$19.95**

Ontario Residents add 7% P.S.T.

Steve's CP/M Wunderdisk! Volume the First

In the course of doing the last year or so of Computing Now! we've generated a lot of code. We've collected all the programs we've written... some of which have never been published in any of our magazines... and put 'em all on one disk. Included are things like STAR, the Gemini 10 printer setup, the Last Wordstar Unhook, CPMAP and the CP/M HOST program, complete with several unreleased support programs.

The Wunderdisk is the best collection of tricky CP/M routines on the planet, ideal for anyone who wants to get inside this powerful operating system and sing. It's also the best documented... the programs, for the most part, are written up in issues of Computing Now!

The Wunderdisk is available for: CP/M **$19.95**

Ontario Residents add 7% PST.

Gemini WordStar PRESS

The WordStar printing function is agonizingly slow. It's also not very obliging in regards to where it puts its page numbers and things like headers.

PRESS is a utility which handles the formatted printing of all sorts of text files, be they manuscripts, drafts, program listings . . . anything that you'd normally want printed out in page form. It installs the header of your choice at the top of each page and slaps the page number beside it.

It also gives you a running count of the number of characters, lines and pages having hit the printer as you go. It allows you to have your documents printed out in a variety of type size and style permutations, commensurate with the capabilities of your printer.

Most important, however, PRESS will send text to your printer, formatted and all, as fast as your printer can accept it. It will even adjust the high bits of WordStar files to avoid selecting the Sanskrit character set.

PRESS comes configured for the Gemini 10X and 15X printers. It will, in fact, be quite happy with most Epson compatible dot matrix printers. A version is also supplied for use with letter quality daisy wheel printers.

PRESS is a simple to use package which communicates with you in plain English.

Available for: CP/M **$19.95**

Ontario Residents add 7% PST.

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Phone Orders and Major Credit Cards Accepted

Software Now!

The difference between we humans and the other inhabitants of the planet, is our capacity for making tools. Civilization is often measured by its grasp of technology . . . it's through his use of tools that man has come to be able to manipulate his environment.

The computer is the ultimate tool . . . it is, like man himself, unspecific, and thus adaptable to virtually any task. The same computer can be a bookkeeper, a game, an artist's palette, a composer's amanuensis, a word processor or a programmer's development station.

The computer itself is simply a box full of chips. The power of computers lie in the software that runs on them.

Software Now! is the magazine for people harnessing the power of the microcomputer. In its pages, you will find the information which you will need to choose and apply the software that will dedicate your computer to your tasks. It will help you make sense of the miriad of similar software packages, translate the intricate complexities of software claims, understand the watershed breakthroughs in software development . . . and even have a bit of time left over to dematerialize a few aliens.

Perhaps most exciting, however, is that the pages of **Software Now!** contains news about software for applications you've never even considered running on your computer. Imagine having an overview of the work of the world's most gifted program developers . . . and you'll have a good idea as to what **Software Now!** is about.

Software Now! deals with a broad range of systems and applications, encompassing eight, sixteen and thirty-two bit machines, and software as diverse as video games, drafting systems and spreadsheets.

Features In The Queue

Here's some of the editorial line up for the next few issues of **Software Now!** You can expect it to change a bit . . . new software springs up almost daily, and **Software Now!** is always featuring the most important developments in this dynamic field.

Computer Aided Drafting On a Micro ● Techniques in MacPaint ● How to choose a Spreadsheet ● Apple Software Crate ● Getting to the Root of UNIX ● The Digital Research Pantry ● A Thousand and One Word Processors ● IBM's Productivity Family ● Can Mac Write? ● Professional Software Roundup ● Power Programs for the 64 ● Approaching the C ● Word Processing Support Programs ● dBASE II Enhancements ● Will it Run Multiuser? ● Concurrent CP/M

Reviews (typically 10 each issue): 10 Base ● Mighty Mail ● WORDBASE ● Easy Script ● Computer Chef ● Electronic Circuit Analysis Program ● Superex Retailer ● MAI Basic Four ● The Print Shop ● TK!Solver ● Microsoft BASIC for the Macintosh ● Sundog ● Turbo PASCAL for the IBM ● AutoCAD ● MultiMate ● Lexicheck and Word Juggler ● Dataflex ● Symphony ● Omniterm 2 ● DB Master ● Paint Magic

In addition to this, look for these regular features:

The Library	(Monthly survey of books)
By The Board	(Public domain software)
Arcade	(A look at the latest games)
Short File	(An overview of new releases)

We've reached a level of development in microcomputer software wherein one needn't be a computer genius to apply a computer. In fact, one can operate a computer with only a bit more expertise than one needs to successfully make toast. The key that will unlock the power of your computer is the software you plug into it.

The key to that software is understanding.
The key to understanding software is Software Now!

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You can't go outside any more without being inundated with advertisements for computers. In fact, even staying inside won't help very much, unless you unplug the TV and the radio and threaten the postman with violence so he'll stay away. Computers are becoming as much a part of our culture as are TV, cars and central heating. In five years, computer illiteracy may be as much of a handicap as print illiteracy was five years ago.

Despite the colourful advertisements that have turned up in the media for computer hardware, micros are still understandably forbidding for many people. In fact, though, most new computer owners are amazed at just how small the leap from unpacking the thing, to getting it to do what they want it to do really is.

A computer is an everything tool. It can do anything you can conceive of having it do, limited only by your own ingenuity in telling it how. This is the art of programming, an experience not unlike that of an artist with every colour of paint imaginable and a blank canvas the size of Australia. However, the canvas of a computer never gets full . . . the more you learn how to do, the more you'll realize it is possible to tackle.

Computing Now! magazine can be the most useful accessory you can buy for your system. Every issue is stuffed full of news about products which will enhance your system, programs to run on it, ideas and applications to give you new things to do with your machine, articles about programming techniques, and tricks to make your computer a better tool for realizing your ideas, and piles of other features to help you get the most out of your system.

Whether you are looking at a computer as a hobby or to run your business, **Computing Now!** can provide you with information and applications to make your system the most useful thing you've ever bought next to the can opener. The articles in **CN!** are written by people who are using computers daily, and are among the most experienced small computer users in the country.

Computing Now! is published and wholly owned in Canada. As such, the articles and advertisements in it relate specifically to products you can get North of the border. There is nothing more frustrating that finding something interesting in an American magazine, only to discover that it will take four months to drag it through customs.

We know microcomputers and we practise what we preach — in fact, we are probably one of the most computerized companies in Canada. Here are just some of the systems we currently own: Apple II and compatibles (15 systems); Apple Macintosh; IBM PC and compatibles (BEST; Corona, Columbia, JLS); Nelma Persona (2); TRS-80 Model II (2); Commodore 64; Vic-20; Commodore PET; ZX81; if800; Acorn Atom; Multiflex. These are just some of the systems we own and use ourselves; our contributing editor's systems are additional to this list.

With powerful computers becoming widely available, you can't afford not to be aware of the expanding universe of micros **Computing Now!** can provide you with an understandable, incisive and varied insight into this powerful new technology. It is written to be both understandable by the beginner and informative for the more experienced user with a depth and variety unequalled by any other contemporary computer publication.

Recent articles: Local Area Networks ● Hexes and How to Throw Them ● Interrupts on the IBM ● Review of Three IBM Clones ● Bandit (a game) ● What is MS-DOS? ● Rescuing Lost Data on the 64 ● Backing Up Protected Disks ● Stockboy (an inventory control program) ● Computer Aided Drawing ● Survey of Portables ● Infomart ● Digging up CP/M ● Drum Card Review for the Apple ● Review of the HP 150 ● Hacking Modem7 ● How to Use the Smartmodem ● CP/M MAC Macro Assembler ● Popular Business Software Directory ● Explaining the IBM Serial Interface ● Directory of Microcomputer Paraphernalia ● Xerox Service Centres ● CN!'s Most Asked Questions ● dBASE II Report Generator ● Dimension 68000 Review ● Review of Radio Shack's 2000 ● IBM Telecommunications ● Business On Line ● A Potful of BASIC Routines ●

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Moorshead Publications Almost Free Software

Almost Free Software #1

Almost Free Software #2

Almost Free Software #3

Almost Free PC Software #1

Almost Free Software #1, #2 and #3 are for CP/M and are available in a variety of formats: Apple // + CP/M, 8 inch SSSD*, Access Matrix, Morrow Micro Decision, Superbrain, Xerox/Cromemco*, Epson QX-10VD, Sanyo MBC 1000, Nelma Persona, Kaypro II, Osborne Single* and double densities, Televideo, DEC VT-180, Casio FP-1000, Zorba.

***single density formats require two disks. The package cost for these formats is $19.95**

Modem7. Allows you to communicate with any CP/M based system and download files. Complete details were in Computing Now! November 1983.

PACMAN. You can actually play PAC-MAN without graphics, and it works pretty fast.

FORTH. A complete up-to-date version of FIG FORTH, complete with its own internal DOS.

DUU. The ultimate disk utility allowing you to recover accidentally erased disk files, fix gorched files, rebuild and modify your system. A real gem.

D. A sorted directory program that tells you how big your files are and how much space is left on the disk.

USQ/SQ. Lets you compress and uncompress files. You can pack about 40% more stuff on a disk with this system.

Finance. A fairly sophisticated financial package written in easily understandable, modifiable Microsoft BASIC.

BADLIM. Ever had to throw out a disk with a single bad sector? This isolates bad sectors into an invisible file, making the rest of the disk useable.

DISK. Allows you to move whole masses of files from disk to disk without having to do every one by hand, you can also view and erase files with little typing.

QUEST. A "Dungeons and Dragons" type game.

STOCKS. This is a complete stock management program in BASIC.

SEE. Also known as TYPE17, will TYPE any file, squeezed or not allowing you to keep documents in compressed form while still being able to read them.

Order as AFS #1 and specify system

BISHOW. Th ultimate file typer, BISHOW version 3.1 will type squeezed or unsqueezed files and allow you to type files which are in libraries (see LU, below). However, it also pages in both directions, so if you miss something, you can back up and see it again.

LU. Every CP/M file takes up unnecessary overhead. If you want to store lots of data in a small space, you'll want LU, the library utility. It permits any number of individual files to be stored in one big file and cracked apart again.

RACQUEL. Everyone should have one printer picture in their disk collection.

MORTGAGE. This is a very fancy mortgage amortization program which will produce a variety of amortization tables.

NSBASIC. Large disk BASIC packages, such as MBASIC, are great... and very expensive. This one, however, is free... and every bit as powerful as many commercial programs. It's compatible with North Star BASIC, so you'll have no problem finding a manual for it.

Z80ASM. This is a complete assembler package which uses true Zilog Z80 mnemonics. It has a rich vocabulary of pseudo-ops and will allow you to use the full power of your Z80 based machine... much of which can't be handled by ASM or MAC.

VFILE Easily the ultimate disk utility, VFILE shows you a full screen presentation of what's on your disk and allows you to mass move and delete files using a two-dimensional cursor. It has heaps of features, a built-in help file and works extremely fast.

ROMAN. This is a silly little program which figures out Roman numerals for you. However, silly programs are so much fun...

CATCHUM. If you like the fast pace and incredible realism of Pacman, you'll go quietly insane over Catchum... which plays basically the same game using ASCII characters. Watch little "C's" gobble periods while you try to avoid the deadly "A's"... It's a scream.

Order as AFS #2 and specify system

OIL. This is an interesting simulation of the workings of the oil industry. It can be approached as either a game or a fairly sophisticated model.

CHESS. This program really does play a mean game of chess. It has an on-screen display of the board, a choice of colours and selectable levels of look ahead.

DEBUG. The DDT debugger is good but this offers heaps of facilities that DDT can't and does symbolic debugging... it's almost like being able to step, trace and disassemble through your source listing.

DU87. The older DUU program does have some limitations. This version overcomes them all and adds some valuable capacities. It will adapt itself to any system. You can search, map and dump disk sectors or files. It's invaluable in recovering damaged files, too.

ELIZA. This classic program is a micro computer head shrinker... It runs under MBASIC, and, with very little imagination, you will be able to believe that you are conversing with a real psychiatrist.

LADDER. This is... this program is weird. It's Donkey Kong in ASCII. It's fast, bizarre and good for hours of eye strain.

QUIKKEY. Programmable function keys allow you to hit one key to issue a multi-character command. This tiny utility allows you to define as many functions as you want using infrequently used control codes and to change them at any time... even from within another program.

RESOURCE. While a debugger will allow you to disassemble small bits of code easily enough, only a true text based disassembler can take a COM file and make source out of it again. This is one of the best ones available.

Order as AFS #3 and specify system

For IBM PC's and genuine compatibles. Available in Double-Sided or two Single-Sided Disks.*

PCWRITE. While not quite Wordstar for nothing, this package comes extremely close to equalling the power of commercial word processors costing five or six bills. It has full screen editing, cursor movement with the cursor mover keypad, help screens and all the features of the expensive trolls.

SOLFE. This is a small BASIC program that plays baroque music. It's also a fabulous tutorial on how to use BASICA's sound statements.

PC-TALK. A Telecommunicatons package for the IBM PC which does file transfers in both ASCII dump and MODEM7/X-MODEM protocols and comes with... get this... 119424 bytes of documentation.

SD. This sorted directory program produces displays which are a lot more readable than those spewed out by typing DIR.

FORTH. This is a small FORTH in Microsoft BASIC. You can build on the primitives intregral with the language.

LIFE. An implementation of the classic ecology game written in 8088 assembler.

MAGDALEN This is another BASIC music program.

CASHACC. This is a fairly sophisticated cash acquisition and limited accounting package written in BASIC. It isn't exactly BPI, but it's a lot less expensive.

DATAFILE. This is a simple data base manager written in... yes, trusty Microsoft BASIC.

UNWS. Wordstar has this unusual propensity for setting the high order bits on some of the characters in the files it creates. Here's a utility to strip the bits and "unWordstar" the test. The assembler source for this one is provided.

HOST2. This is a package including the BASIC source and a DOC file to allow users with Smart-Modems to access their PC's remotely. It's a hacker's delight.

Order as AFPCS #1 Specify Double-Sided or 2x Single-Sided.*

All of this software has been obtained from public access sources and is believed to be in the public domain. The prices of the disks defer the cost of reproducing them and mailing them, plus the cost of the medium. The software itself is offered without charge. A few items include messages imbedded in the code asking for voluntary donations on behalf of the authors.

Moorshead Publications warrants that the software is readable and if there are defects in the medium, we will replace it free of charge. While considerable effort has been made to ensure that programs are thoroughly debugged, we are unable to assist in adapting them for your own applications.

$16.95 each

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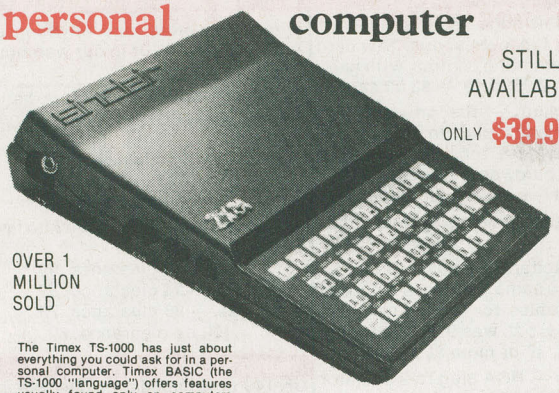
Timex TS-1000 personal computer

2K Memory expands to 64K



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The Timex TS-1000 has just about everything you could ask for in a personal computer. Timex BASIC (the TS-1000 "language") offers features usually found only on computers costing two or three times as much. It is an ideal computer for learning programming. It is also excellent for your children's education, and for household and business management. The TS-1000 hooks up to a standard black and white television; programs are stored on an ordinary cassette recorder.

- Unique 'one-touch' key word entry; the 1000 eliminates a great deal of tiresome typing. Key words (PRINT, LIST, RUN, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.

COMPLETE WITH ALL ACCESSORIES

- Graph-drawing and animated display facilities.
- Multi-dimensional string and numeric arrays.
- Up to 26 FOR/NEXT loops.
- Randomize function.
- Programmable in machine code.
- Cassette LOAD and SAVE with named programs.
- 2K-byte RAM (expandable).
- Full editing facilities.

16K RAM

$49.95

We will supply Memotech or Timex RAM depending on availability

64K Gladstone RAM **$99.95**

2040 Printer $99.95

Works on ZX81, TS1000, TS1500, TS2068

Now you can have hardcopy printouts of your computer calculations and graphics! 32-column dot-matrix thermal printer. Full-screen program-controlled printing. Quiet operation. Compatible with all Timex Sinclair computers.

4 rolls extra paper — $19.95

TOP 5 PROGRAMS FOR TIMEX/SINCLAIR

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FLIGHT SIMULATION: Voted in the TOP TEN of Best Programs available for ANY MICROCOMPUTER in the U.K.. True simulation of flying a small aircraft. Excellent educational and pilot instructional aid.

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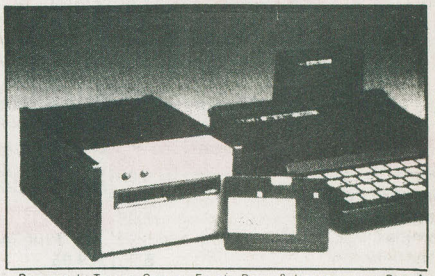

PICTURED IS TS1000, STRINGY FLOPPY DRIVE & INTERFACE 16K RAM AND A MICRO WAFER

- Data transfer rate 10.4K baud
- 30 times faster than cassette
- Typical access time for 16K — 8 seconds
- Automatic Verify with SAVE
- Plugs into expansion port
- Up to 127 files
- Works for BASIC or ML
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- Program chaining capabilities

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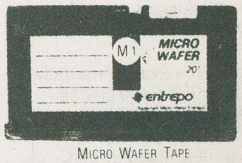

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CAN STORE 85K

At last! Similar in design and appearance to the ZX Micro drive Model 2000 listed above, we now offer lowcost high speed mass storage for 2068 users. The high speed 11K baud transfer rate loads a 28K program in 24 seconds. Simple to use — just plugs into expansion port. Comes with 5 wafers, full instructions, and 90 day warranty. Extra wafers, order model M2000 — same price schedule as M-1 listed above. Price of $319.95 includes interface for 2 drives, and includes 1 drive. For 2nd drive, order Model 2000-1 drive only, at $249.95.

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TS-2050 Modem

$229.95 3 or more at $215.00 each

- Works with ZX81, TS1000, TS1500, TS2068
- Auto answer, auto dial
- Direct connect — plugs into phone jack
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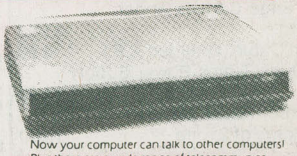
- **Perfect companion to Compuserve Starter Package**



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2068 SOFTWARE & HARDWARE

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VU-3D	29.95	Tasmath* (trig., algerbra)	39.95
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		Battleship*	29.95
		Yahtzee*	29.95
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Computers for Kids —ZX-81 Ed.	6.95
49 Explosive Games — ZX-81	19.95

Software: ZX-81/TS 1000

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Zombies	5.95
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ZX Forth	14.95
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Krakit (an intellectual challange)	5.95
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Memocalc (Spreadsheet)	69.95
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Memotech (empty case as used on Rams)	5.00
ZX-81 Edge Card/extender board.	11.95
Output Cable (shielded R.F.)	3.50
9V/650 ma Timex Power Supply	14.95
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Book "How to Grow into 1 Megabyte with ZX-81"	FREE
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Ram 64	69.95
Drom (Battery Back-up)	99.95
Toolkit	59.95
Pericon A (24 lines I/O)	69.95
Pericon B (drives relays)	69.95
Pericon C (Centronics out)	99.95
Sonus (3 voice Synthesiser)	79.95

Acorn Atom Related Software

All titles listed below only **$9.95 each**. If type ordered is sold out we will substitute a similar tape, unless order specifies other wise.

Layrinth	Invasion	Ravine
Dam Busters	Reversi	Solt Racer
Stock Broker	3D 0X0	Sheep Dog
Sketch Pad	Territory	Zombies
Alien Maze	Condense	Ski Run
Maze Ball	Break Away	Anteaters
Yan	The Park	Junior Games Pack

Acorn Hardware

16K RAM (by Time Data), expands 12/12 to 28K. Blanks sockets for expansion to 32K. (was $240) **$99.95**

Acorn Hardware continued

Acorn Hardware continued

Cassette Cable	4.50
Colour Board	24.00
MB-1 (9V 1.75A pwr. supply)	16.95
MB-3 (5V 3A pwr. supply)	29.95
2114 Memory Chips 20 for	29.95
Work Pack Rom	37.95
Programmer's Toolbox	35.00
Atomcalc spreadsheet	35.00
Machine Code Monitor/Dis.	35.00

Vic-20 Hardware

16K Plug-in Expansion was $124.95 **$79.95**

Micro-expansion chassis (plugs into Vic-20 expansion port for connection of two further expansion devices) was $48.95 **$24.95.**

Apple Compatible Hardware Plug In Boards:

Speech card — complete with software and manual	$59.95
Interger Card	65.00
Disk Interface Card	59.95
Z80A Card	59.95
16K Card	69.95
80 Column Card	99.95
Communications card & Cable	69.95
RS-232 Card & Cable	59.95
Cooling Fan	59.95

Light Pen Set, complete with software and manual (was $324.95) **$199.95**

16K printer Buffer includes graphics card. Made in U.S. by Practical Periphals. (was $285.) **$125.00**

32K same as above was $335. **$175.00**

Other Apple Compatible Hardware

Regular style cabinet with Keyboard	119.95
Numeric Cabinet & Keyboard	189.95
Bare Mother Board	39.95
48K Mother Board with all ICs fully loaded	395.00
RF Modular with TV Switch and output cable	11.95
80/40 Column Switch	9.95
5 Amp Power Supply	89.95
Joystick	29.95
Cooling Fan	65.00

Apple Related Software

Wordstar, version 2.2 from MicroPro. Best price ever! (was $449.95) **$275.00**

Incredible Jack (integrated word-processor, spreadsheet, calculator) was 229.95 **$119.95**

Audio Department

10 Band Stereo Equalizer, operates in tape monitor circuit
Was $199.95 Clearance **$75.00**

Ground Eliminator Kit — from ACE Audio, eliminates audio system ground loops, system hum, and noise, etc. (2 required for stereo) clearance **$19.95**

C-90 Audio Magnetics Cassette tape, Low Noise — High Output, 3 tapes per package

1 - 9 packs	$1.99
10 - 24 pakcs	1.75
25 up packs	1.50

Audio Department continued

Cermaic Cartridge, BSR style complete with flip over stylus. Standard half inch mounting centres, with hardware. (was 9.95) sale — **$3.00** each

Guitar Pickup — fits on accoustic guitar for direct plug in to amp. Includes volume & tone contol, cable. (Mounting hardware not supplied)
was $30.00 clearance **$9.95**

8 Track Head cleaning System
was $9.95 clearance **$1.99**

Low Capacitance Audio Cable — RCA plug to same. Replaces standard shielded cables for lower noise and better highs. 5 ft. was 9.95. Clearance **$3.95** each, 10 or more $2.50 each.

RCA Cable — RCA plug to 2 alligator clips, shielded, 5 ft.
was $4.00 clearance **$1.75**
10 or more $1.25

RCA Cable — RCA plug to tinned leads, shielded, 5 ft.
was $3.75 clearance **$1.59**
10 or more **$1.15**

Wire and Parts:

300 ohm flat 2 conductor antenna down lead
25 ft. roll clearance .99
50 ft. roll clearance 1.90
75 ft. roll clearance 2.89
100 ft. roll clearance 3.50

2 Conductor Shielded cable (2 wires plus shield). Specify length. Was .70 ft. cleance .25 ft.

Speaker wire — 20 guage, polarized, high conductance, American made 2 conductor cable, cut to any length.
1 to 1000 ft. clearance .12 ft.
1000 ft. up clearance .09 ft.

12 Volt Power Supply — 2A continuous output, 3.75 A surge. Runs CB, auto stereo, etc. in home.
was $39.95 clearance **$19.95**

20 Assorted Transistors — Includes Motorola, I.R., etc., all new, (about $20.00 vlaue) clearance **$4.99**

3 Pound Surprise Kit — A shovel load of parts including resistors, capacitors, transistors, hardware,

Wire and Parts continued

wire, connectors, and anything else we have cartons of in our warehouse. **$4.99**

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1 — 24 clearance 3.00
25 — 99 clearance 2.50
100 up clearance 2.00

AC Line Cord — 5 ft., white, (was $3.00)
1 — 9 clearance .99
10 — 24 clearance .89
25 — 99 clearance .79
100 up clearance .69

Amtron Kits

UK-140 Low Impedance Mic. Preamp. was 7.95 **3.95**
UK-135 Hi Impedance Mic. Preamp. was 7.95 **3.95**
UK-235 Inattentive Driver's Alarm was $20.00 **8.95**
UK-275 Universal Mic. Preamp was $12.95 **5.00**
UK-920 RF mixer, amp. 2.3-27 Mhz was $15.00 **5.95**
UK-167 RIAA Preamp was $22.00 **11.95**
UK-990 C.B. Antenna Noise Filter was $12.95 **3.95**
EC-100 Code Practice Oscillator was $26.95 **9.95**

EICO Kits

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AM Radio	12.00
Decision Maker	8.95
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ESP Tester	12.00
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Super roulette wheel	19.95
Love-O-Meter	9.95
Morse Code Practice Oscillator	14.25
Curiosity Box	12.00
Executive Decision Maker	15.95
Electronic Shootout (gunfight	21.95
Audio (LED) Power Meter	19.95
Fish Caller	15.20
Electronic Siren	16.70

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AD5780M4	5 x 7 oval, 6 watt full rangedual cone 4 ohm	$ 3.00
AD6980M4	6 x 9 oval, 6 watt full range dual cone 4 ohm	$ 7.50
AD6980M8	same as above, 8 ohm	$ 7.50
AD4691X4	4 x 6 oval, 4 watt, 4 ohm	$ 4.00
AD4691M8	4 x 6 oval, 6 watt full range dual cone 8 ohm	$ 4.00
AD4681P8	4 x 6 oval 6 watt full range single cone 8 0hm	$ 4.00
AD7062M8	7" octagonal 30 watt full range dual cone 8 ohm	$ 9.95
AD7064M8	7" octagonal 20 watt full range dual cone 8 ohm	$ 7.95
AD12100W8	12" 40 watt woofer, 40 oz. mag., rubber surround, 8 ohm	$39.95
AD12100W4	same as above, 4 ohm	$39.95
AD1265W4	12" 30 watt woofer, 16 oz., 4 ohm	$29.95
AD1265W8	same as above, 8 ohm	$29.95
AD1065M8	10" 10 watt full range, dual cone, 8 ohm	$24.95
AD1265M4	12" 20 watt full range, dual cone, 4 ohm	$24.95
AD8061W4	same as above, 4 ohm	$15.95
AD7080M4	7" octagonal 6 watt full range dual cone	$ 9.95
AD7080X4	7" octagonal 6 watt M.P. single cone	$ 9.95
AD2070	2" tweeter, 10 watts round, paper cones specify 4, 8 or 15 ohm	$ 2.00

Audax Speakers Factory Sale

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MHD21B37 8" Bextrene Woofer was $85.00 . . . . . **$48.95**

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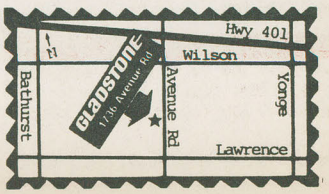

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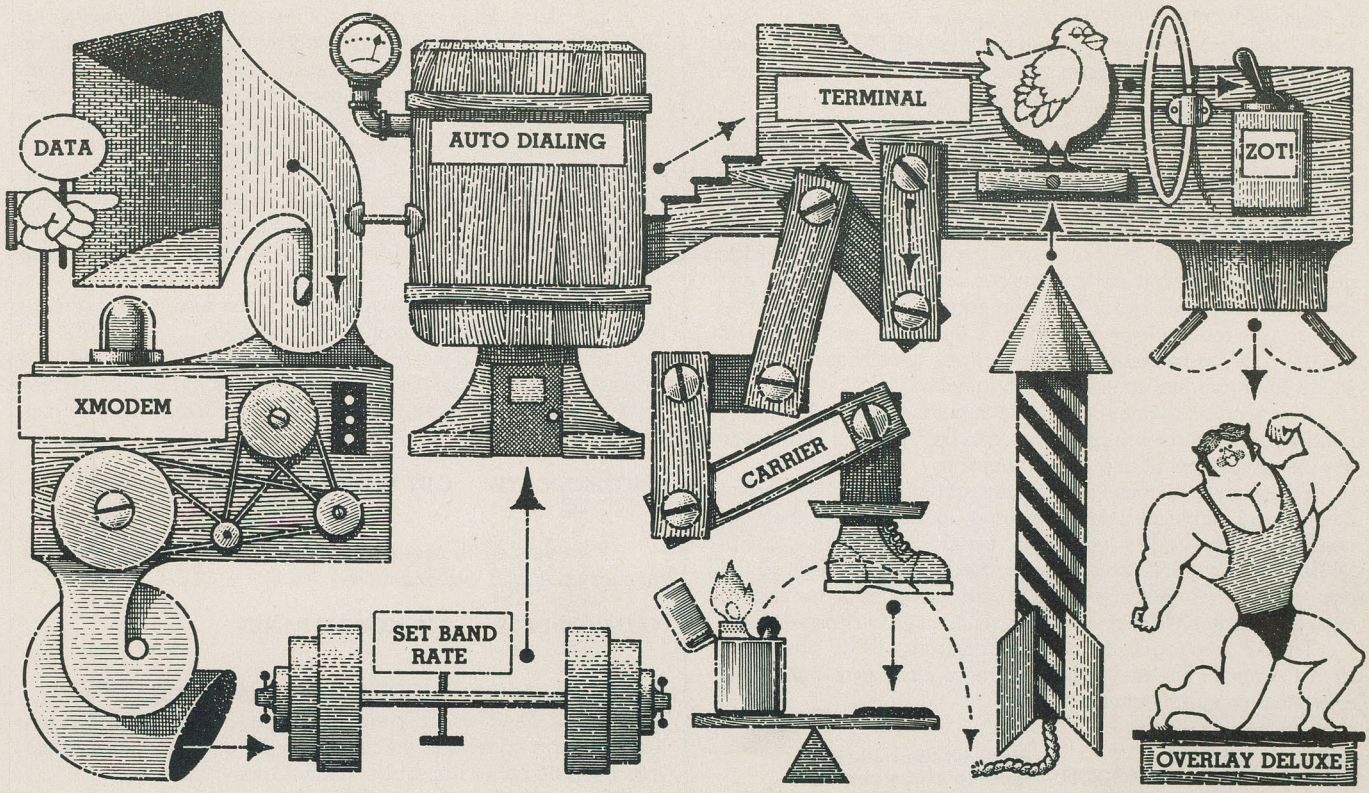
The Art of The MDM Overlay



If you've sat down to write an MDM7 overlay for your computer you'll probably appreciate how involved the process can be. Here's a look at some techniques for creating the overlay of the gods.

by Steve Rimmer

There was a time when MODEM7 packages were very uncivilized, and it would have been largely impossible to have talked about the patching of the this most useful of telecommunications programs in a general sense. Depending upon which version of the program you happened to have acquired, what hacks had been made to it by the last soul that possessed it and other profound considerations, such as the colour of your postman's socks, the patching needed to adapt it to a specific machine could range from changing a few equates to adding twenty kilobytes of code.

Making a version of MODEM7 work on your computer is, nonetheless, a worthwhile enterprise. Having gotten it going one has immediate access to megabytes worth of software all available for free on public domain bulletin boards. More sophisticated uses for MODEM7 include moving files between dissimilar... and largely incompatible... computers.

Their potential utility, however, never really did make the MODEM programs any easier to get going. They are among the most tempermental little nasties available.

The successors to the nine million versions of MODEM7, the MDM trips, are a lot easier to work with and an order of magnitude easier to patch and make cool. Among other things, they have all their nasty system dependant bits concentrated in a block of code which is overlayed, that is, replaced with your own routines. This makes them potentially a lot easier to work with, as you don't have to manipulate a massive program, skipping through it to look for the hardware dependant aspects of it.

We looked at how the overlay code for MDM works in the July 1984 edition of Computing Now!. In this feature we'll look at an example of what the system specific code can look like, and some of the techniques one can use to render it more than just a quick patch.

It would probably be a good trip to check out the July article again if you aren't all that familiar with the bits and bytes.

Overview

Both MDM7 and a full size blue Chevy pickup full of system specific overlays are available in the public domain. However, it can be said of some of these latter things, at least, that they only work in the theoretical sense. They are useable in the same way that a teletype is useable as a terminal. They'll make the package go, but they won't make it very much fun to use.

This, of course, is a drag, because MDM7 is such a powerful little brute. It has heaps of features and options, all of which can make your life much more real if they're supported by the overlay.

The overlay shown here is a fairly powerful example of what these things are all about. While a bit trickier to write than a low

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budget deal to just get the package up and working would have been, this code supports everything that MDM7 can do, and handles a number of low level system functions a lot more conveniently than would one of the low rent versions.

The first and potentially the most limiting restriction in writing an MDM7 overlay is the space you have to do it in. If you want to retain the dialing code of the package, which resides immediately below the overlay space the overlay must end before 0400H.

This does not, however, allow you anything like this much room to write code in. The space from 0100H to 01A8H is unrepentantly spoken for by various configuration bytes and jumps into the overlay for the main code block. As such, what you add to the package must fit in the space from 01A8H to 0400H. This seems like a lot, but when you actually start working with it the room fills up exceedingly quickly.

In writing an overlay for your computer you should keep in mind what the code is supposed to handle. To begin with, there are the obvious input and output functions.

The overlay divides the inputting and outputting of modem data into a number of unique functions. In the order of their appearance, the code wants the serial port status... that's IN$MODCTL1... followed by a routine to send data out to the port, then to get data into the port and, finally, four routines to mask and compare the receive and send status bits respectively.

This all goes together, through calls from MDM7 proper, to form a terminal. This may make a bit more sense if we look a how a terminal program actually works.

```
CALL     INITMOD          ;first, set the baud rate
REMOTE:  CALL  IN$MODCTL1 ;get the port status byte
CALL     ANI$MODRCVB      ;mask off the receive status
CALL     CPI$MODRCVR      ;see if it's set
JNZ      LOCAL            ;check local if not
CALL     IN$MODDATP       ;otherwise, get the remote data
CALL     CONOUT           ;and show it on the screen
LOCAL:   CALL  CONSTAT    ;see if there's a keyboard char
JNZ      REMOTE           ;if not, back to the serial port
CALL     CONIN            ;otherwise get the keyboard char
CALL     OUT$MODDATP      ;and send it to the serial port
JMP      REMOTE           ;loop again
```

This is a simplified terminal couched in the terms used in the overlay code. However, looking at the component bits this way it's fairly easy to see what the functional blocks do.

To begin with, we have to initialize the serial port, and possibly the modem. This is, in fact, the aspect of the code which takes the most work, since it is in initializing the serial port that we will be setting up the baud rate and suchlike.

We'll be having a more detailed look at this stuff in a bit.

The terminal itself is comprised of a large loop which runs from REMOTE down to the jump at the bottom of this little program. In fact, it consists of two smaller sections which perform analogous functions. The top half operates on data coming in from the serial port... the remote console... while the bottom bit handless data coming from the keyboard, not surprisingly the local console.

The steps involved in each of these can be seen as follows. The first thing to do is to check the status of the console in question. If there is no character waiting, the program must jump to the start of the other section and check for a character there. If both consoles are idle the program will loop back and forth like this indefinitely. If there is a character ready at the console, it will get it and send it out to the other console. Having gotten this together, the program resumes looping, waiting for another character.

In order to fill in the seriach of the routines is allowed a certain amount of space, as is indicated by the location markers on the far right of the listing, and, as such, complex routines may involve putting JMP statements in these spots pointing further down into the overlay where there's a bit more breathing room.

It's unspeakably important to assure that these routines all start where they're supposed to. When the MDM7 code wants to initialize the serial port, for example, it will call location 0168H. If the jump to this code is somewhere else your computer will transmute itself into a three headed Venusian gas lizard and swallow itself tail first.

At least, I think that's what it'll do. To be sure, whatever happens will be uncool to watch.

To this end, make sure that in writing these simple I/O routines that you fudge the DS things to reflect the size of the code you've written. For example, the OUT$MODDATP routine currently consists of

```
OUT$MODDATP:    OUT MODDATP ! RET
        DS      7
```

If we wanted to create an overlay for an Apple, which is memory mapped, we might use

```
OUT$MODDATP:    STA MODDATP ! RET
        DS      6
```

In this case, the label MODDATP would be a sixteen bit value... an address... and, as such, would take up a byte more than the eight bit port address in the first example. Correspondingly, the space defined after it must be made a byte smaller.

If you are going to radically hack this part of the overlay you can check the SYM listing produced by the assembler against the memory locations in this overlay to make sure everything's wound up where it's supposed to.

Now... the Fun Part

Actually, the rest of the overlay is a lot more interesting to write, and rather less critical. This is, in fact, where you can really get away with nothing at all... or you can really shine.

The rest of the overlay does what amounts to the system specific human engineering for your computer. For the most part this involves handling the baud rate setup and port initialization.

Most simple overlays make the port default to three hundred baud and offer a few other speeds using the MDM7 SET command. This is a drag if your hardware can handle lots of baud rates. You may well want the higher ones, for example, to transfer data through a hard wire between computers some time in the future.

This overlay, for example, will set the port of the computer it was written for to anything up to a hundred and ninety-two kilobaud. MDM7 runs like a rabbit on speed at this rate... it's a party for moving files between systems.

There are two things which I think the baud rate setup should do... and that most overlays don't. To begin with, it should read the default baud rate byte at MSPEED, location 107H in the overlay, and set the port up accordingly. As such, one could change the default baud rate with DDT by simply altering this byte.

Secondly, it should tell you what baud rate the port is set to when the program is booted and when you use the SET command.

It should also allow for the disabling of the auto baud rate setup feature. In this version, whether or not the port is initialized

to the baud rate set by MSPEED or to three hundred baud, as most overlays do it, is determined by the setting of the EXTRA1 byte at 11EH, which I've renamed to BAUDINT here for the occasion.

The code to handle the automatic baud rate setup is a bit tricky. Normally this sort of thing is fairly simple, but in this case there isn't much room to bounce around in. If you glance down toward the bottom of the listing you'll find a host of little routines, starting with OK110. As it happens, probably due to celestial intervention when the 8080 chip was devised, these routines are eight bytes long. This is rather handy, as eight is an easy number to work with.

If we take the location of OK110 as a base and add eight times the value of the MSPEED byte the result will be a pointer to the corresponding setup routine. I know this sounds like fractured mathematics, but it works extremely well. The value of the accumulator can be multiplied by eight by rotating it left three times.

```
; ----------------------------------------
;
;       Overlay Delux Example
;       A typical MDM7 overlay file
;       For a generic computer
;       Copyright (c) 1985
;
; ----------------------------------------

; NOTE THAT THE LINES OF CODE THAT WILL PROBABLY WANT CHANGING TO SUIT
; YOUR HARDWARE ARE MARKED WITH ASTERISKS AT THE FAR RIGHT

BELL:           EQU     07H
CR:             EQU     0DH
ESC:            EQU     1BH
LF:             EQU     0AH

YES:            EQU     0FFH
NO:             EQU     0

PORTA           EQU     YES             ;SET ONE TRUE TO SELECT ONE
PORTB           EQU     NO              ;OF TWO AVAILABLE SERIAL PORTS

                IF      PORTA
BAUDRG:         EQU     00H             ;BAUD RATE GENERATOR ADDRESS        *
PORT:           EQU     04H             ;SERIAL DATA PORT                   *
MODCTL1:        EQU     PORT+2          ;SERIAL STATUS PORT                 *
MODDATP:        EQU     PORT            ;MODEM DATA PORT                    *
MODCTL2:        EQU     PORT+2          ;MODEM STATUS PORT                  *
                ENDIF

                IF      PORTB
BAUDRG:         EQU     0CH             ;BAUD RATEGENERATOR ADDRESS         *
PORT:           EQU     05H             ;SERIAL DATA PORT                   *
MODCTL1:        EQU     PORT+2          ;SERIAL STATUS PORT                 *
MODDATP:        EQU     PORT            ;MODEM DATA PORT                    *
MODCTL2:        EQU     PORT+2          ;MODEM STATUS PORT                  *
                ENDIF

MODRCVB:        EQU     01H             ;BIT TO TEST FOR RECEIVE
MODRCVR:        EQU     01H             ;MASK FOR READY TO RECEIVE
MODSNDB:        EQU     04H             ;BIT TO TEST FOR SEND
MODSNDR:        EQU     04H             ;MASK FOR CLEAR TO SEND

                ORG     100H

                DS      3       ;(for  "JMP   START" instruction)

PMMIMODEM:      DB      NO      ;yes=PMMI S-100 Modem                       103H
SMARTMODEM:     DB      YES     ;yes=HAYES Smartmodem, no=non-PMMI          104H
TOUCHPULSE:     DB      'P'     ;T=touch, P=pulse (Smartmodem-only)         105H
CLOCK:          DB      40      ;clock speed in MHz x10, 25.5 MHz max.      106H *
                                ;20=2 MHh, 37=3.68 MHz, 40=4 MHz, etc.
MSPEED:         DB      9       ;0=110 1=300 2=450 3=600 4=710 5=1200       107H
                                ;6=2400 7=4800 8=9600 9=19200 default
BYTDLY:         DB      1       ;0=0 delay  1=10ms  5=50 ms - 9=90 ms       108H
                                ;default time to send character in ter-
                                ;minal mode file transfer for slow BBS.
CRDLY:          DB      1       ;0=0 delay 1=100 ms 5=500 ms - 9=900 ms     109H
                                ;default time for extra wait after CRLF
                                ;in terminal mode file transfer
NOOFCOL:        DB      5       ;number of DIR columns shown                10AH
SETUPTST:       DB      YES     ;yes=user-added Setup routine               10BH
SCRNTEST:       DB      YES     ;Cursor control routine                     10CH
ACKNAK:         DB      YES     ;yes=resend a record after any non-ACK      10DH
                                ;no=resend a record after a valid NAK
BAKUPBYTE:      DB      YES     ;yes=change any file same name to .BAK      10EH
CRCDFLT:        DB      YES     ;yes=default to CRC checking                10FH
TOGGLECRC:      DB      YES     ;yes=allow toggling of CRC to Checksum      110H
CONVBKSP:       DB      NO      ;yes=convert backspace to rub               111H
TOGGLEBK:       DB      YES     ;yes=allow toggling of bksp to rub          112H
ADDLF:          DB      NO      ;no=no LF after CR to send file in          113H
                                ;terminal mode (added by remote echo)
TOGGLELF:       DB      YES     ;yes=allow toggling of LF after CR          114H
TRANLOGON:      DB      YES     ;yes=allow transmission of logon            115H
                                ;write logon sequence at location LOGON
SAVCCP:         DB      YES     ;yes=do not overwrite CCP                   116H
LOCONEXTCHR:    DB      NO      ;yes=local command if EXTCHR precedes       117H
                                ;no=external command if EXTCHR precedes
TOGGLELOC:      DB      YES     ;yes=allow toggling of LOCONEXTCHR          118H
LSTTST:         DB      YES     ;yes=printer available on printer port      119H
XOFFTST:        DB      NO      ;yes=check for XOFF from remote while       11AH
                                ;sending a file in terminal mode
XONWAIT:        DB      NO      ;yes=wait for XON after CR while            11BH
                                ;sending a file in terminal mode
TOGXOFF:        DB      YES     ;yes=allow toggling of XOFF checking        11CH
IGNORCTL:       DB      YES     ;yes=CTL-chars above ↑M not displayed       11DH
BAUDINT:        DB      YES     ;yes=auto baud init                         11EH
EXTRA2:         DB      0       ;for future expansion                       11FH
BRKCHR:         DB      'B'-40H ;↑@ = Send a 300 ms. break tone             120H
NOCONNCT:       DB      'N'-40H ;↑N = Disconnect from the phone line        121H
LOGCHR:         DB      'L'-40H ;↑L = Send logon                            122H
LSTCHR:         DB      'P'-40H ;↑P = Toggle printer                        123H
UNSAVE:         DB      'R'-40H ;↑R = Close input text buffer               124H
TRANCHR:        DB      'T'-40H ;↑T = Transmit file to remote               125H
SAVECHR:        DB      'Y'-40H ;↑Y = Open input text buffer                126H
EXTCHR:         DB      '↑'-40H ;↑↑ = Send next character                   127H

                DS      2               ;                                   128H
IN$MODCTL1:     MVI     A,10H           ;FUDGE INTERUPT                     12AH *
                OUT     MODCTL1                                             *
                IN      MODCTL1         ;GET STATUS                         *
                RET                                                         *
                DS      3                                                   *

OUT$MODDATP:    OUT     MODDATP ! RET   ;SERIAL DATA OUT                    134H
                DS      7
IN$MODDATP:     IN      MODDATP ! RET   ;SERIAL DATA IN                     13EH
                DS      7
ANI$MODRCVB:    ANI     MODRCVB ! RET   ;CHECK FOR READY TO RECEIVE         148H
CPI$MODRCVR:    CPI     MODRCVR ! RET   ;SEE IF BIT IS SET TO RECEIVE       14BH
ANI$MODSNDB:    ANI     MODSNDB ! RET   ;CHECK FOR CLEAR TO SEND            14EH
CPI$MODSNDR:    CPI     MODSNDR ! RET   ;SEE IF BIT IS SET TO SEND          151H
                DS      6               ;                                   154H
OUT$MODCTL1:    OUT     MODCTL1 ! RET   ;OUT TO SERIAL STATUS PORT          15AH
OUT$MODCTL2:    OUT     MODCTL2 ! RET   ;SAME AGAIN...                      15DH

LOGONPTR:       DW      LOGON           ;POINTER TO "HELLO"                 160H
                DS      6               ;                                   162H
JMP$GOODBYE:    JMP     GOODBYE         ;                                   168H
JMP$INITMOD:    JMP     INITMOD         ;JUMP TO PORT INITIALIZER           16BH
                RET  !  NOP  !  NOP     ;(by-passes PMMI routine)           16EH
                RET  !  NOP  !  NOP     ;(by-passes PMMI routine)           171H
                RET  !  NOP  !  NOP     ;(by-passes PMMI routine)           174H
JMP$SETUPR:     JMP     SETUPR          ;                                   177H
JMP$SPCLMENU:   JMP     SPCLMENU        ;                                   17AH
JMP$SYSVER:     JMP     SYSVER          ;                                   17DH
JMP$BREAK:      JMP     SENDBRK         ;                                   180H
; Do not change the following six lines.
JMP$ILPRT:      DS      3               ;                                   183H
JMP$INBUF       DS      3               ;                                   186H
JMP$INLNCOMP:   DS      3               ;                                   189H
JMP$INMODEM     DS      3               ;                                   18CH
JMP$NXTSCRN:    DS      3               ;                                   18FH
JMP$TIMER:      DS      3               ;                                   192H

; Clear sequences -- CLREOS is clear to end of screen, CLRSCRN is clear
; entire screen.  Last entry must be 0.  Any other 0's act as NOP's.

CLREOS:         CALL    JMP$ILPRT       ;                                   195H
                DB      11h,0,0,0,0     ;                                   198H *
                RET                     ;                                   19DH

CLRSCRN:        CALL    JMP$ILPRT       ;                                   19EH
                DB      1Ah,0,0,0,0     ;                                   1A1H *
                RET                     ;                                   1A6H

SYSVER:         CALL    JMP$ILPRT       ;                                   1A7H
                DB      '[ Overlay for an obscure comoputer ]'
                DB      '[ Copyright  1985 (c) Steve Rimmer ]',0
                RET

; IF THE TRANSLOGON BYTE IS TRUE, THIS MESSAGE WILL HAPPEN IF YOU
; HIT CONTROL O

LOGON:          DB      'Hello',0

; THIS SENDS A 300 MS BREAK TONE TO RESET TIME SHARING COMPUTERS

SENDBRK:  MVI   A,5             ;YOU CAN LARGELY IGNORE                     *
          OUT   MODCTL1         ;THIS ROUTINE FOR MOST                      *
          MVI   A,0F8H          ;APPLICATIONS...                            *
          JMP   GOODBYE1        ;

; THIS HANGS UP THE PHONE, MAKING THE DTR LOW AND SENDING A BRK TONE

GOODBYE:  MVI   A,5                                                         *
          OUT   MODCTL1         ;TO THE STATUS PORT                         *
          MVI   A,68H           ;SET DTR LOW                                *
;
GOODBYE1: OUT   MODCTL1         ;SET DTR LOW NOW                            *
          MVI   B,3             ;WAIT FOR 300 MS.                           *
          CALL  JMP$TIMER                                                   *
          MVI   A,5                                                         *
          OUT   MODCTL1         ;SET DTR HIGH AGAIN                         *
          MVI   A,0E8H          ;RESTORE PARAMETERS                         *
          OUT   MODCTL1                                                     *
          RET
```

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```
; THIS INITIALIZES THE PORT, SETS THE BAUD RATE AND SO ON

INITMOD:  MVI   A,0             ;SELECT REGISTER                    *
          OUT   MODCTL1                                             *
          MVI   A,18H           ;SET TO RECEIVE COMMAND             *
          OUT   MODCTL1                                             *
          MVI   A,04H           ;SELECT REGISTER                    *
          OUT   MODCTL1                                             *
          MVI   A,44H           ;SET PARAMETERS                     *
          OUT   MODCTL1                                             *
          MVI   A,03H           ;SELECT REGISTER                    *
          OUT   MODCTL1                                             *
          MVI   A,0C1H          ;ENABLE RECEIVE                     *
          OUT   MODCTL1
          MVI   A,05H           ;SELECT REGISTER
          OUT   MODCTL1
          MVI   A,0EAH          ;ENABLE SENDING
          OUT   MODCTL1
;
          LDA   BAUDINT         ;SEE IF AUTO BAUD RATE SETUP
          CPI   YES             ;IF NOT ENABLED, JUST INITIALIZE
          JNZ   INITMOD1

;         AUTO BAUD RATE SETUP
;         IF ENABLED, THIS CODE LOOKS AT THE MSPEED BYTE AND SETS THE
;         BAUD RATE ACCORDINGLY. TO DISABLE, MAKE THE BAUDINT BYTE 0

DEFBD:    LDA   MSPEED          ;SEE WHAT THE DEFAULT SPEED IS
          RLC                   ;MULTIPLY BY 2
          RLC                   ; ... BY 4
          RLC                   ; ... BY 8
          LXI   D,0             ; MAKE D = A
          MOV   E,A
          LXI   H,OK110         ;POINT TO FIRST BAUD RATE
          DAD   D               ;ADD OFFSET
          PCHL                  ;AND JUMP TO IT
;
INITMOD1: MVI   A,1             ;DEFAULT TRANSFER TIME TO 300 BAUD
          STA   MSPEED          ;SET UP MSPEED BYTE ACCORDINGLY

          CALL  JMP$ILPRT       ;SAY IT
          DB    CR,LF,'Baud rate ',0
          LDA   MSPEED          ;GET MSPEED BYTE
          LXI   H,STR110        ;POINT TO VECTOR TABLE
          RLC                   ;MULTIPLY MSPEED BY 2
          LXI   D,0             ;MAKE D = A
          MOV   E,A
          DAD   D               ;H IS POINTING TO VECTOR
          MOV   E,M             ;GET LOW ORDER VECTOR BYTE
          INX   H               ;BUMP H POINTER
          MOV   D,M             ;GET HIGH ORDER VECTOR BYTE
          XCHG                  ;H NOW POINTS AT STRING
INITLP:   MOV   A,M             ;GET A BYTE OF THE STRING
          CPI   0               ;IF IT'S ZERO, WE'RE DONE
          JZ    INITMOD2        ;OTHERWISE,
          MOV   E,A             ;SET UP TO DO CONOUT BDOS CALL
          MVI   C,2             ;
          PUSH  H               ;SAVE THE POINTER
          CALL  5               ;AND PRINT THE BYTE
          POP   H               ;RESTORE THE POINTER
          INX   H               ;BUMP IT
          JMP   INITLP          ;AND LOOP 'TIL DONE
;
INITMOD2: MVI   A,05H           ;INITIALIZE TO 300 BAUD             *
          OUT   BAUDRG          ;AND SET THE BAUD RATE. NOTE THAT   *
          RET                   ;THE 05 WILL BE OVERWRITTEN BY SETBAUD

STR110:   DW    SEE110          ;THE TABLE OF POINTERS TO THE STRINGS
STR300:   DW    SEE300
STR450:   DW    NOSEE           ;NO 450 BAUD
STR600:   DW    SEE600
STR710:   DW    NOSEE           ;NO 710 BAUD
STR1200:  DW    SEE1200
STR2400:  DW    SEE2400
STR4800:  DW    SEE4800
STR9600:  DW    SEE9600
STR192:   DW    SEE192

; Setup routine to allow changing modem speed with the SET command.

SETUPR:   LXI   D,BAUDBUF       ;POINT TO NEW INPUT BUFFER
          CALL  JMP$ILPRT
          DB    'Select a baud rate: '
          DB    '110, 300, 600, 1200, 2400, 4800, 9600, 19200: ',0
          CALL  JMP$INBUF
          LXI   D,BAUDBUF+2
          CALL  JMP$INLNCOMP    ;COMPARE BAUDBUF+2 WITH CHARACTERS BELOW
SEE110:   DB    '110',0         ;IS IT "110"?
          JNC   OK110           ;IF SO, LEAP TO SETUP
          CALL  JMP$INLNCOMP    ;AND SO FORTH
SEE300:   DB    '300',0
          JNC   OK300
          CALL  JMP$INLNCOMP
SEE600:   DB    '600',0
          JNC   OK600
          CALL  JMP$INLNCOMP
SEE1200:  DB    '1200',0
          JNC   OK1200
          CALL  JMP$INLNCOMP
SEE2400:  DB    '2400',0
          JNC   OK2400
          CALL  JMP$INLNCOMP
SEE4800:  DB    '4800',0
          JNC   OK4800
          CALL  JMP$INLNCOMP
SEE9600:  DB    '9600',0
          JNC   OK9600
          CALL  JMP$INLNCOMP
SEE192:   DB    '19200',0
          JNC   OK192

          CALL  JMP$ILPRT
NOSEE:    DB    'not available.',CR,LF,BELL,0
          JMP   SETUPR          ;TRY AGAIN

OK110:    MVI   A,0
          LHLD  BD110
          JMP   LOADBD

OK300:    MVI   A,1
          LHLD  BD300
          JMP   LOADBD

OK450:    JMP   INITMOD1
          DS    5               ;PLACE HOLDER FOR 450

OK600:    MVI   A,3
          LHLD  BD600
          JMP   LOADBD

OK710:    JMP   INITMOD1
          DS    5               ;PLACE HOLDER FOR 710

OK1200:   MVI   A,5
          LHLD  BD1200
          JMP   LOADBD

OK2400:   MVI   A,6
          LHLD  BD2400
          JMP   LOADBD

OK4800:   MVI   A,7
          LHLD  BD4800
          JMP   LOADBD

OK9600:   MVI   A,8
          LHLD  BD9600
          JMP   LOADBD

OK192:    MVI   A,9
          LHLD  BD192
          JMP   LOADBD          ;THIS ONE ISN'T REALLY NECESSARY
LOADBD:   STA   INITMOD1+1      ;CHANGE MSPEED
          MOV   A,L             ;GET BAUDRATE BYTE                  *
          STA   INITMOD2+1      ;MODIFY INITMOD ROUTINE             *
          JMP   INITMOD1        ;AND SET UP THE BAUD RATE

; TABLE OF BAUDRATE PARAMETERS

BD110:    DW    0002H
BD300:    DW    0005H
BD600:    DW    0006H
BD1200:   DW    0007H
BD2400:   DW    000AH
BD4800:   DW    000CH
BD9600:   DW    000EH
BD192:    DW    000FH

BAUDBUF:  DB    10,0            ;CONSOLE BUFFER TO ENTER BAUD RATE
          DS    10

SPCLMENU: RET                   ;THIS ISN'T USED. JUST LEAVE IT HERE
ZZZEND:   EQU   $               ;THIS VALUE MUST BE LESS THAN 0400H
                                ;TYPE OVERLAY.SYM TO SEE IT
          END
```

If you check out DEFBD you'll see how this works. A pointer is devised into the appropriate OK routine and used to fill the program counter with the infrequently used PCHL instruction.

Using this approach it is not only high tech to use as many of the available baud rates as possible... it's almost essential. Because the pointer into the OK routines moves in increments of eight bytes, there has to be a routine every eight bytes and it has to be the right one. This computer couldn't support four-fifty or seven hundred and ten baud and, as a result, I've had to fudge these with dummy jumps to keep the spacing right.

The function of the OK routines is twofold. They can be called from either the initial setup routines or through the SET command from MDM, so they must get the parameters to set up the port and they have to change the byte at MSPEED. This latter bit is, admittedly, redundant when they're called from the initialization.

In most cases the baud rate parameter is a sixteen bit word. It usually takes the form of the upper and lower bytes of a divisor. This particular computer uses an 8116 baud rate generator,

which only allows for a fixed set of commonly used baud rates. As such, only four bits are required to select a rate. I've preserved the sixteen bit table here, however, to illustrate what it would look like if it were all being used.

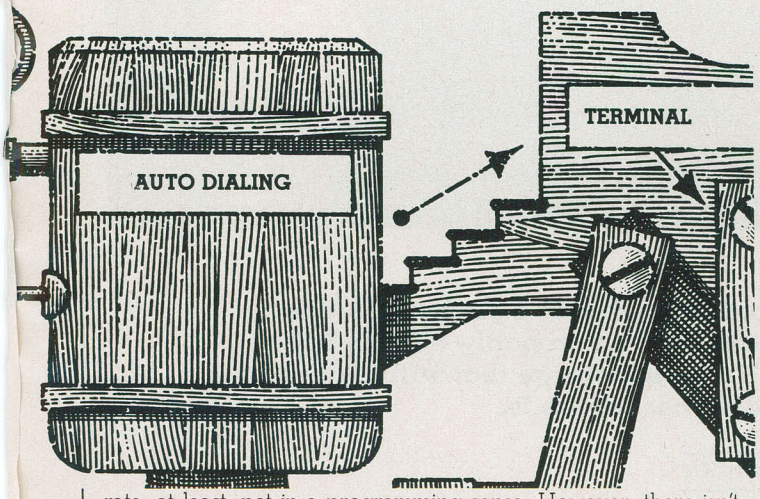
The LOADBD routine is what actually sets the baud rate... and, of course, it will have to be changed to suit your hardware, as must the table of baud rates beneath it. In most cases, it will treat the two eight bit halves of the HL register as individual values, moving them to the accumulator and sending them out to the appropriate ports.

Strings

The final bit of nuance which I feel an overlay should possess if it really wants to be able to call itself an overlay is the facility for telling you which baud rate you've selected after you've selected it. This is only of trifling importance when the SET command is used... you should know what you've typed in, after all... but it's decent when you first boot the program. As this overlay can be easily set up to initialize itself to different baud rates by just changing the MSPEED byte with DDT, it's quite easy to wind up with a number of versions of MDM, all having differing parameters on starting up.

Yes, you can look at the status page when you first sign onto the cruise, but that's so low tech it hardly bears thinking about.

It's not at all difficult to have the system print out the baud



rate, at least, not in a programming sense. However, there isn't really enough spare room in the overlay to do this here. As such, getting it together requires some stealth.

The SETUPR routine compares the data inputted into BAUDBUF to a series of fixed strings, these strings being the baud rates. Checking this out, we might note that these are the very strings we would need to print out if we wanted to say what the baud rate is.

Unfortunately, unlike as in the case of the OK routines, these strings do not occur at convenient regular intervals, as they are not of a constant length. We can't just fudge an offset and derive a pointer to to the strings based on the value of MSPEED... at least, not directly.

The table at STR110 is the way around it. By assigning each string a label and then creating a table consisting of these labels we've set up a structure which can be manipulated with relatively little effort.

To select a baud rate string based on the value of MSPEED the INITMOD1 routine gets MSPEED in A and rotates it left once, that is, multiplies it by two. If the HL register points to STR110, adding A to it will have it pointing to the string corresponding to the baud rate in A.

The overlay won't let one select invalid baud rates, like seven hundred and ten baud in this case, but it is possible to set MSPEED to default to this value. As such, since the table needs dummy place holders anyway we'll have these pointers aim at the string that says "not available".

Classic Baud

Even the simplest modem program can transfer files. The MDM7 deals can make transferring them kind of executive and high tech. However, a lot depends on your overlay.

You can, of course, create still more sophisticated overlays by obtaining the source for one of the MDM7s and re-assembling it with more room before the dialing code. I mean, you can have full screen menus, colour, sound effects and a mouse interface, cognitive error trapping, speech recognition... probably best to skip the speech recognition part, actually.

A well designed MDM overlay is a sort of eternal thing. It'll make adapting the package to different tasks moderately painless, and will assist you in carrying out the grand purpose of Western civilization, showing off for your friends.

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Circle No. 26 on Reader Service Card

The Mortgage Program

The word *mortgage* is from the Latin *mortuus*, to die, and *gage*, to pledge... in other words, a death pledge. If you have one you probably already knew that even if you don't understand Latin. Here's a program that will help you calculate just how deadly your pledge is.

by Jim Buchner

Whether you lend money, sell real estate on commission, buy and sell property, sell loan schedules, or just want to have the ability to investigate alternatives on your personal loan or mortgage and print out a schedule, you may find this program useful.

When I began to prepare this program I thought that it might have limited appeal, mainly for persons like myself who dabble in real estate. I have since found interest in the program among friends who wish to weigh the possibilities before they renew their mortgages, and another who works full time in real estate.

The program makes it possible to examine alternative mortgage variables like interest rates, the time interval between payments, the amortization period, the number of compoundings per annum and the period of time which the loan will be allowed to run. Then, if the user likes the result, a schedule can be printed.

In the Code

There are several things unique about this program. The payments may be made at one, two, three, four, six or twelve month intervals. The compounding may be semi-annual or at such other interval as desired... but do note that semi-annual compounding is standard. The amortization period need not be a whole number of years but can be any number of years and months you choose. The interest rate and principal amount can be any decimal numbers you supply.

No set of mortgage tables that financial institutions use can supply all this flexibility conveniently. This is where the computer provides advantages if it is programmed to do so.

Another major advantage of this program over a standard program for printing out mortgage schedules is that it allows one to investigate alternatives before making the decision to commit

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Circle No. 15 on Reader Service Card

The Mortgage Program

```
20  REM  C=COMPOUNDS/YEAR:IR=INTEREST RATE:IX=INTEREST FACTOR:P=PRINCIPAL
    :PY=PAYMENT:T=TIME(YEARS TO PAYMENTS):IR/100=INTEREST AS A DECIMAL:M
    SP=PAYMENTS TO PRINTOUT:DY=DELAY:MC=PAYMENT COUNTER
30  REM    IA=CURRENT INTEREST:PA=PAYMENT ON PRINCIPAL:BA=BALANCE:NP=NO.
    PAYMENTS PER YEAR
40  REM   TI=CUMULATIVE INTEREST:TP=CUMULATIVE PRINCIPAL:FP=FINAL PAYMENT
    (USED ONLY WHERE MSP<T)
50  CLEAR : HOME
60  HTAB 10: VTAB (5): PRINT "PLEASE ANSWER THE PROMPTS,"
70  HTAB 10: PRINT "TO SET UP LOAN SCHEDULE."
80  PRINT : PRINT : PRINT "PRINCIPAL?";: HTAB 20: INPUT "$";P
90  PRINT : PRINT "RATE, %/ANNUM?";: HTAB 20: INPUT "";IR
100 IR = IR / 100:C = 2:NP = 12
110  PRINT : PRINT "WILL PAYMENTS BE MONTHLY? N/Y": GET X$: IF X$ = "Y" THEN
     GOTO 130
120  INPUT "THEN HOW MANY PAYMENTS PER YEAR? ";NP
130  PRINT : PRINT "2 COMPOUNDINGS / YEAR?  N/Y";: GET X$: IF X$ = "Y" THEN
     GOTO 150
140  PRINT : INPUT "THEN HOW MANY COMPOUNDINGS / YEAR? ";C
150  PRINT : PRINT : PRINT "IS TERM IN FULL YEARS?  N/Y";: GET X$: IF X$ =
    "Y" THEN  GOTO 170
160  PRINT : INPUT "THEN ENTER THE TOTAL NUMBER OF PAYMENTS TO COMPLETE T
    ERM ";T: GOTO 190
170  PRINT : PRINT "FULL TERM IN YEARS ";: HTAB 25: INPUT T:T = T * NP
180  REM  CALCULATE INTEREST FACTOR
190 IX = ((1 + IR / C) ^ (C / NP) - 1)
200  REM    PAYMENT FORMULA:ROUND UP
210 PY = (P * IX) / (1 - (1 + IX) ^ ( - T)):PY =  INT (PY * 100 + 1) / 10
    0
220 Z1 = PY: GOSUB 750
230  HOME
240  VTAB 5: FLASH : PRINT "PAYMENTS WILL BE $"Z1$: NORMAL : PRINT
250  PRINT "HOW MANY PAYMENTS SHOULD SCHEDULE BE": PRINT "PRINTED?  (PRES
    S <0> THEN <RETURN> TO"
260  PRINT "REVISE DATA OR QUIT BEFORE PRINTING)";: INPUT MSP
270  IF MSP <  = 0 THEN  GOTO 400
280  IF MSP <  = T THEN  GOTO 310
290  PRINT : PRINT "YOU CANNOT EXCEED THE TERM OF THE LOAN"
300  PRINT "PRESS <RETURN> TO REENTER";: GET F$: IF F$ =  CHR$ (13) THEN
     GOTO 230
310 D$ =  CHR$ (4)
320  PRINT : PRINT D$;"PR#1": PRINT
330 BA = P:MC = 0:TI = 0:TP = 0
340  GOSUB 440: GOSUB 450: GOSUB 440: GOSUB 500
350  FOR MC = 1 TO MSP: GOSUB 540: NEXT :
360  GOSUB 650
370  PRINT D$;"PR#0"
380  HOME
390  PRINT "WOULD YOU LIKE ANOTHER COPY OF": PRINT  TAB( 4);"THE SAME SCH
    EDULE Y/N?";: GET X$: IF X$ = "Y" THEN  GOTO 320
400  HOME : VTAB 10: PRINT "PREPARE ANOTHER LOAN?  N/Y";: GET X$: IF X$ =
    "N" THEN  GOTO 420
410  GOTO 50
420  HOME : VTAB 10: FLASH : PRINT "SIGNING OFF THEN.....";: FOR DY = 1 TO
    2000: NEXT : NORMAL : HOME
430  END
440  FOR X = 1 TO 70: PRINT "*";: NEXT : RETURN
450  PRINT : PRINT  CHR$ (13); TAB( 20);"PRINCIPAL $";P
460  PRINT "AMORTIZED OVER ";T;" PAYMENTS @ ";IR * 100;" % COMPOUNDED ";C
    ;" TIMES ANNUALLY"
470  PRINT "INTEREST FACTOR ";IX; TAB( 5);"PAYMENTS ARE $";PY;" PER ";12 /
    NP;" MONTHS"
480  PRINT  CHR$ (13)
490  RETURN
500  PRINT : PRINT  CHR$ (13)"DATE   PAYMENT"; TAB( 10);"INTEREST"; TAB(
    12)"PRINCIPAL"; TAB( 10);"BALANCE"
510  PRINT "____  _______"; TAB( 10);"________"; TAB( 12);"_________"; TAB(
    10);"_______"
520  RETURN
530  REM  PAYMENT SCHEDULE CALCULATIONS
540 IA =  INT ((BA * IX * 100) + .5) / 100
550 PA = PY - IA:BA = BA - PA
560  IF MC = T THEN PA = (PA + BA):BA = 0
570 TI = (TI + IA):TP = (TP + PA)
580  REM  SPACING PAYMENT SCHEDULE
590 A1 = MC:X = 14: GOSUB 790
600 Z1 = IA:X = 16: GOSUB 730
610 Z1 = PA:X = 18: GOSUB 730
620 Z1 = BA:X = 18: GOSUB 730
630  PRINT : REM  FORCE CARRIAGE RETURN
```

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Circle No. 21 on Reader Service Card

The Mortgage Program

```
640  RETURN
650  IF MSP < T THEN  GOTO 680
660 FP = (IA + PA):Z1 = FP: GOSUB 750
670  PRINT : PRINT  CHR$ (13);"FINAL PAYMENT IS $";Z1$
680 Z1 = TP: GOSUB 750
690  PRINT  CHR$ (13); CHR$ (13);: HTAB 10: PRINT "TOTAL PRINCIPAL PAID:
     $";Z1$
700 Z1 = TI: GOSUB 750
710  HTAB 10: PRINT "TOTAL INTEREST PAID: $"; LEFT$ (Z1$,J + 2): RETURN
720  REM  SPACE AND PRINT INT, PRIN, BAL
730  GOSUB 730: PRINT  TAB( X - J)Z1$;: RETURN
740  REM    ENSURES ONE DIGIT BEYOND SECOND DECIMAL:ROUNDS TO CENTS
750 Z1$ =  STR$ (Z1): FOR J = 1 TO  LEN (Z1$): IF  MID$ (Z1$,J,1) <  > ".
     " THEN  NEXT J
760  IF (J + 2) >  =  LEN (Z1$) THEN Z1 = Z1 + .001
765 Z1$ =  STR$ (Z1):Z1$ =  LEFT$ (Z1$,(J + 2))
770  RETURN
780  REM  NUMERIC TO STRING VALUE FOR YEAR AND MONTH
790 A1$ =  STR$ (A1):K =  LEN (A1$)
800  REM    SPACE AND PRINT (DATE) AND PAYMENT NUMBER
810  PRINT  TAB( X - K)A1$;: RETURN
```

the results to hard copy. One may enter all the variables I've noted. The program then branches to tell the operator what the payments will be. The operator then has the option to print out the schedule for as long a time period as is desired, or to revise data input before printing. Thus the program permits one to explore before deciding to print out a schedule.

After printing a schedule, duplicate copies of the same schedule may be produced, or different schedules may be set up, all without restarting the program.

The mathematical advantages of the program are apparent when one examines a sample printed schedule. The payments are rounded up to the whole cent, rather than to the nearest cent. Lest one think that this favours the leader let me hasten to add that this means that the last payment of a schedule that runs full term will always be a little smaller and that there will be no surprising extra balance to pay at the end.

The interest payments and principal payments are totalled to the end of the print out time, thus satisfying the requirement for full disclosure of information.

The difficult part of preparing this schedule was in formatting the output. I have worked on this to produce what I believe is a well balanced very readable display. The system I used was an Apple //e with an Epson MX 80 printer. If you use any other hardware you may experience some problems unless you are aware of the adaptations that must be made to suit your configuration. However no tricky programming techniques are used. Standard BASIC is used throughout, so there should be no serious problems to adapting this code to run in another environment.

Inside the program...

Because the working of a mortgage program can be a bit complex even if you have it spread out before you, here's a look at the functional elements of the code.

Lines beginning with REM may be omitted with no loss to the program if you wish to save memory space. Please do not apply that to line 10.

Where a space has been left at the beginning or end of a bracket make sure to include it.

20 to 40 Identify all the variables used
50 Sets cursor at home position and clears the memory.
60 to 70 Prompts for input data.
180 to 190 Calculates the interest factor.
200 to 220 Calculates the payment value and rounds it upward.
230 to 240 Homes the cursor and flashes payments.
250 to 300 Provides the option to print the schedule for a specified number of payments or to revise the data.
310 to 320 Turn on printer.
330 Ensures that the variables that count or total are set to zero and that the balance starts at the principal amount.
340, 440 to 490 Sets up the header containing input data.
500 to 520 Sets up the headings for tabular data.
350 Counts the payments.
530 to 550 Calculates and rounds off the schedule data payment by payment.
560 Cleans up the final principal and balance payments.
570 Totals the interest and principal payments.
580 to 640
720 to 810 Spaces payment schedule so columns are right justified.
740 to 770 Ensures that all the money data will contain two digits after the decimal, rounded properly.
360, 650 to 670 Prints out the final payment if printed schedule runs full term.
680 to 710 Formats and prints the total principal and interest paid.
370 Turns the printer off.
380 to 390 Allows one to choose to print another copy of the same schedule and the program picks up from line 320.
400 to 410 Allows one to choose to prepare a different loan, and the program starts over at line 50.
420 to 430 Flashes sign off to end the program and return control to the user.

When you are ready to run the program, make sure your printer is on and the paper is in position. If you have no printer, omit lines 310, 320 and 370. **CN!**

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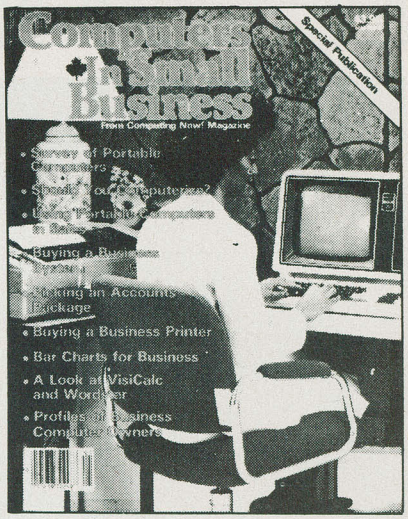

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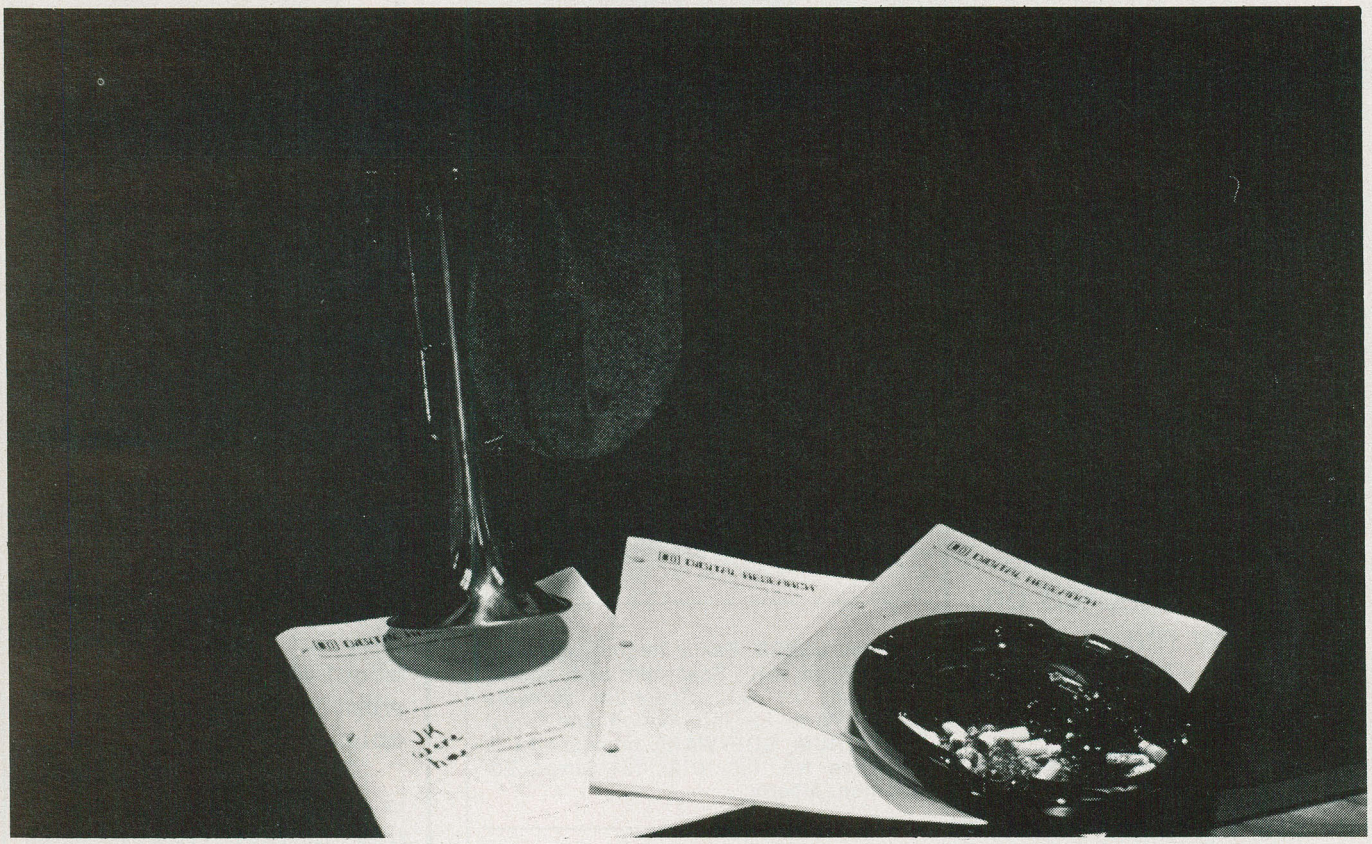
BeatNix for CP/M



There are a lot of good things about CP/M... but it lacks excitement. Every time you turn it on it does the same old prompt, gives you the same old BDOS errors on drives you haven't got. You probably need BeatNix, the operating system you write yourself.

by Steve Rimmer

After a while, as the vines start growing up your legs and overwhelming your computer table, you'll find that you can get quite comfortable using CP/M... in very much the same way that South American generals get comfortable in front of a firing squad, I think. While you may become familiar with this interesting bit of antiquity, few souls ever really grow to like it.

There are, of course, decidedly more interesting alternatives. Perhaps the most reclusive of these is BeatNix, which, despite its obviously splendid human engineering and unfathomable flexibility is almost unheard of among most computer users. This may well be because of the relatively low profile which it has maintained in the world of basement level code, or, even more possibly, because I just made it up the other day.

The BeatNix operating system, or, more properly, command processor, is a replacement for the CP/M CCP, in much the same way as is ZCPR2, which we looked at in the January 1985 edition of Computing Now!. Unlike ZCPR2, however, BeatNix is a fairly simple program which can be easily understood... and more to the point, modified... by most users. It assembles with the simplest of tools and can be got going without too much trouble.

The best part about BeatNix, however, is its potential for being strange. While ZCPR2 attempts to emulate and enhance the CP/M environment, BeatNix creates a working rapport with its users unlike that of any other computer operating system. You can decide just how obtuse you want the syntax of it to be.

Eat To The Beat

If you were to look at a map of CP/M you would see the following stuff. Starting with location zero, there would be a JMP instruction to the warm boot vector of the system BIOS. Following this there is the IOBYTE, a set of flags which the BIOS is supposed to use to tell it how to handle the console and the system ports. Next we have the BDOS jump vector, the system RST vectors... these are never used in programs, except for this one... and then some buffers.

The transient program area starts at 100H and runs up until the start of the CCP. This is where programs go to do their things. The start of the CCP can be located by noting that CCPs always start 1600H below the BIOS. The BIOS starts three bytes below the warm boot vector and, as we can locate this from the JMP instruction down at location zero we can... through a fairly convoluted process... find the start of the CCP.

The CCP, or console command processor, is the part of CP/M which talks to you. What, you mean your computer *doesn't* talk to you... hmmm, maybe you have the wrong CCP.

Returning to sea level for a moment, the CCP has the responsibility of printing the command prompt on the screen, accepting what you type and making sense of it. This includes doing the built in commands, such as DIR and TYPE in the case of CP/M, and running the transient commands which you have on your disks. This, in turn, involves some low level housekeeping activities and other mundane tasks.

Unlike your BIOS, which was written specifically for your computer, the CCP is essentially the same code for all implementations of CP/M 2.2. The only difference amongst stock CCPs is where they're located, which is usually a factor of the amount of RAM in the system and the size of the BIOS.

Because we know what the CCP has to do it's eminently practical to write a new CCP. Changing the CCP allows one to make it behave the way one wants it it to, rather than the way someone thought computers should behave in the late seventies. One could, for example, have a menu driven CCP, or one with different built in commands.

The only limitation to all of this is that the CCP must fit into two K of space, 0800H bytes, as this is all the room CP/M allows for it. Now, you can do a lot in this space. To begin with, you can eliminate those commands you don't need. This will free up quite a bit of room. More advanced CCP replacements are usually written in Z80 code, rather than 8080, as this allows for relative jumps, string manipulations and other tight instructions unique to the Z80. This, of course, is a drag if you have an older computer which uses an 8080 or a newer one with an 8085. It also entails the ownership of either a Z80 compatible assembler, such as M80, or a macro assembler like MAC and Z80.LIB to fake the additional instructions.

The BeatNix CCP replacement isn't anywhere near this slick. Based on the premise that a little bit of weird code is a lot more interesting than a whole pile of tight bytes, it fits into the two K space with ease. If you elect to implement BeatNix and subsequently modify it you might want to tighten it up to allow for breathing room. However, I have sought to keep this version small and manageable.

If you look at it you should be able to understand what a CCP actually does.

All That Jazz

Unlike most other programs, the CCP doesn't assemble into a COM file because it doesn't load up into the transient program area to run. Rather, the CCP code is merged into the system, stuck on the disk and put in high memory the next time the computer is booted.

The usual process for doing this is to assemble the code, producing a HEX file. You would create a system image by doing

```
A►SYSGEN
Source drive (or RETURN to skip):A
Destination drive (or RETURN to reboot):
A►SAVE 40 CPM.COM
```

This gets the system from drive A, placing it at 0900H in memory, which is usually just above the SYSGEN program itself. The SAVE command then takes this image and creates a file with it. You may have to grab more than forty sectors... your user's manual should speak regarding this subject.

The next bit of the process is somewhat tricky, in that it varies from computer to computer. The HEX file of the CCP program must be merged into the image such that it lands exactly on top of the old CCP. However, the CCP is now down in low memory somewhere just above 0900H. The HEX file wants to go live where the CCP is supposed to be, 1600H bytes below the BIOS up at the top of RAM.

The way around this is to read the CCP into the SYSGEN image with a offset. This is just a value which is added to the location of every byte in the HEX file so that it winds up somewhere other than where it wants to go. In this case, we'll pick an offset so large that when it's added to the proper location of the CCP it will wrap clear around and start at location zero again. Thus, the new CCP will turn up in low memory, where we want it.

In order to figure the offset we must know where in memory the CCP really lives, which, as you'll see in a moment, is also necessary for the successful assembly of the BeatNix code. This is fairly easy to find with DDT. Having run DDT, do an L0 command, which will disassemble the jump instruction at location zero. Take the operand of this instruction, which might be, for example E603H. The low order byte is always 03. Subtract 1600 from this, ignoring the low byte. You can use DDT to do this, with the command HE600,1600. The answer, in this case, is D000, which is where the CCP lives.

The other bit of data you'll need is the location of the CCP in your SYSGEN image. This is usually at 0980H, but not always. The CCP starts with two jump instructions followed by a Digital Research copyright notice. You can, as such, start searching with DDT until you find it.

You can now calculate the offset with the H command, doing, in this case, HD000,0980. The offset in this case is 3980.

The moment is now upon us. To inhale the new CCP into the SYSGEN image you would, in this case, do

```
A►DDT CPM.COM
-IBEATNIX.HEX
-R3980
```

Apple BeatNix

Getting BeatNix up on the Apple][+ under CP/M takes a bit of doing because there is no SYSGEN utility provided by Microsoft. You *can* do it, however, provided you have CPM56 and are happy using a fifty-six K system.

The CCP for the Apple starts at C400, which is the value you should use for the CCP equate in the code... where I have D000H in the example. Assemble BeatNix with DEBUG set FALSE, which should leave you with a HEX file.

Now DDT CPM56.COM. If you look at 0E00H you should find the CCP. Do

```
IBEATNIX.HEX
R4A00
```

and look at 0E00H again. The CCP should now hold the literals and stuff from BeatNix. Hit a control C and type

```
SAVE 47 BEAT56.COM
```

Run BEAT56 as if it were CPM56... which it more or less is. When you are finished you'll have a working bootable BeatNix system on whatever disk you've initialized with BEAT56.

Make sure you don't beat up on your master... always hack on copies.

BeatNix for CP/M

If you now look at 0980H you should see the new CCP in place. You can now make this image permanent by leaving DDT and running SYSGEN, skipping the source disk prompt so that SYSGEN will use the modified image that's already lurking about in RAM. Actually, since you created the image with SYSGEN you'll probably find that SYSGEN is already present in your image below the CCP. As such, you can usually run it without leaving DDT by typing G0100.

Rebooting the computer... or, in fact, just typing a control C... will make the new CCP active.

The only other consideration in all this is for Apple users, inasmuch as Apple CP/M doesn't come with SYSGEN. There is a way around this, too. Check out the appropriate box elsewhere in this article.

Now For The Strange Bits

Having seen how the CCP is integrated into the system it should be a bit easier to understand exactly how this whole party comes down. What remains is understanding what the thing does, and, more to the point, how.

Any code which lives at the location which the system regards as the start of the CCP will run when the BIOS finishes a warm boot. The standard form of a CP/M CCP, however, has it start with two jump instructions and a CP/M string buffer. This latter phenomenon consists of a byte which represents the length of the buffer, followed by a byte in which the length of the string typed into the buffer will be stored, followed by the buffer itself. This is the buffer used by the CCP when you type in commands.

The BeatNix CCP starts at ENTRY:. The ORG value is determined with DDT, as we checked out above. While we don't have to preserve the structure of the CP/M CCP in BeatNix for it to work, there are some programs which will locate the CCP and do things to the buffer portion of it. It is a good trip, as such, to make sure that they'll find familiar ground.

The BeatNix code, to begin with, has a number of peculiarities. These are largely deliberate... operating systems have never been satisfactorily weird. You can enhance or eliminate these things as you see fit.

To begin with, the built in commands of BeatNix are few. I didn't want the code to run for miles and, as such, I've made the whole affair fairly simple. There is room to add quite a bit more stuff, especially if you take out the HELP function.

The commands I've chosen for BeatNix are lifted from Unix, for no particularly good reason. Drive A under CP/M is drive one under BeatNix, although you can make it drive A again by changing the value of DISKOFF. The command to type files is CAT, and getting a disk directory involves FILES. The DRIVE command... yes, you've guessed it... changes drives. In the interest of simplicity I've ignored the user areas. HELP prints a one page screen of instructions. The BeatNix prompt is

[1]

You can actually make BeatNix behave just like CP/M if you feel you must, but it's so much more funky to do it this way.

In fact, despite the sort of esoteric nature of BeatNix, the code that comprises it is pretty top down. Looking at it from the start on in, the two jump instructions are where they are so that other software can locate the CCP and execute a warm boot either with or without the processing of the command in the console buffer. The command that I've installed in it here is CAT HELLO, which types the file HELLO on drive one. You can change this, or remove it entirely by simply making the CHRCNT byte zero.

You'll note that the vector that doesn't run the command in the buffer simply nulls this byte.

The command processor itself consists of two parts. The first bit gets the command in from your keyboard through the function ten BDOS call. This is how the real CCP does it, so the command line will behave the same as it does under CP/M. The second half decides what to do about the command.

This part could be a lot more sophisticated, but, once again, it would have involved everyone typing in a lot of code.

In deciding what to make of a command BeatNix begins by comparing it to the ones it knows about, to wit, the internal command names. It uses ILCOMP for this, an internal routine which compares the string pointed to by the DE register to the one immediately after the call. There's a more complete explanation of ILCOMP in the PC Utility Blues article in the February 1985 edition of Computing Now!.

Both ILCOMP, and the in line print utility ILPRT, which we've encountered before, work a bit differently under BeatNix than they normally do in that the terminator of a string for either of them is any character with its high bit set. Another way of saying this is that to signify the end of a string you take the last character and add 80H to it.

This approach is useful in things like a CCP because ordinary terminator characters waste space. Admittedly, the verbose help page wastes space too.

If one of the transient strings matches the input string the program will jump to the appropriate routine and execute the code it finds there. The internal commands are pretty straight forward, and probably don't require much explanation.

If none of the internals match the next trip is to see if there's a command on the disk with the name that's been typed in. The first thing to do is to create a file control block which holds the command name and the extension COM to attempt to open the file.

The running of a COM file is actually pretty simple. Assuming that there actually is one going under the name that has been typed into the buffer the system will load it into memory just like a text file, starting at 0100H, and then call the transient program area, which is the entry point for all COM files.

If the program ends with a RET instruction it will return directly to BeatNix, finding itself at the JMP instruction just before the help page. This, in turn, will pop it back to the command line. If it ends with a warm boot jump the BIOS will send it back to the first JMP in the CCP, restarting the whole circus.

```
; BEATBEATBEATBETBEATBEATBEATBEATBEATBEATBEATBEATBEATBEAT
;
;       BeatNix Operating System
;       a small ccp replacement for heads
;       that can't get into zcpr2
;
;       Copyright (c) 1985 Steve Rimmer
;
;       ''Yonder goes the luminous wombat. Pray,
;       follow his beat into the light...''
;
; BEATBEATBEATBETBEATBEATBEATBEATBEATBEATBEATBEATBEATBEAT

TRUE    EQU     0FFFFH
FALSE   EQU     0000H

VERS    EQU     6               ;VERSION
SUBVERS EQU     9               ;SUBVERSION

DEBUG   EQU     FALSE           ;TRUE FOR MEDDLING

        IF      DEBUG
CCP     EQU     0100H           ;MAKE CCP START AT TPA
        ELSE
CCP     EQU     0D000H          ;CCP STARTS HERE
        ENDIF
```

```
SDEEP   EQU     24              ;DEPTH OF SCREEN
SWIDE   EQU     80              ;WIDTH OF SCREEN
BUFLEN  EQU     80H             ;MAXIMUM BUFFER LENGTH
BDOS    EQU     0005H           ;THE BDOS ENTRY
DMA     EQU     0080H           ;DMA BUFFER
FCB     EQU     005CH           ;THE FILE CONTROL BLOCK
COMTAIL EQU     0080H           ;COMMAND TAIL

        IF      DEBUG
TPA     EQU     8000H           ;WHERE TPA STARTS
        ELSE
TPA     EQU     0100H           ;WHERE TPA STARTS
        ENDIF

MAXDSK  EQU     2               ;HIGHEST DRIVE SUPPORTED
WILDCRD EQU     '*'             ;WILD CARD CHARACTER
CR      EQU     13
LF      EQU     10
EOF     EQU     26              ;END OF FILE CHARACTER
BRK     EQU     3               ;CONTROL C TO BREAK

DISKSP  EQU     ':'             ;DISK SPECIFIER CHARACTER
DISKOFF EQU     '0'             ;DISK SPECIFIER OFFSET

        ORG     CCP
ENTRY:  JMP     CPR             ;EXECUTE COMMAND IN BUFFER
        JMP     CPR1            ;DON'T DO COMMAND IN BUFFER

BUFSIZ: DB      BUFLEN          ;MAXIMUM BUFFER LENGTH
CHRCNT: DB      0               ;NUMBER OF VALID CHARS IN COMMAND LINE
CMDLIN: DB      'CAT HELLO'     ;DEFAULT (COLD BOOT) COMMAND
        DB      0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
CRIGHT  DB      'BeatNix ',VERS+'0',SUBVERS+'0'
        DB      ' Copyright 1985 (c) Steve Rimmer'
CRTEND  DB      0
        DS      BUFLEN-($-CMDLIN)+1     ;TOTAL IS 'BUFLEN' BYTES
LINCNT  DB      0               ;PAGING BUFFER
COM     DB      'COM'           ;EXECUTABLE FILE EXTENSION

;
CPR1:   XRA     A               ;SET END OF COMMAND LINE
                                 SO NO DEFAULT COMMAND
        STA     CMDLIN          ;FIRST CHAR OF BUFFER
CPR:    LXI     SP,STACK        ;RESET STACK
        CALL    SETDMA          ;POINT DMA TO DMA BUFFER

LOGIN   MVI C,14 ! MVI E,0 ! CALL BDOS  ;LOG IN DRIVE A
        MVI C,32 ! MVI E,0 ! CALL BDOS  ;USER 0
        MVI C,13 ! CALL BDOS            ;REST DISK SYSTEM
        JMP     PROCMD                  ;JUMP INTO PARSER

GETLIN:         ;SHOW PROMPT AND GET A COMMAND
        CALL    DRVCODE                 ;GET THE CURRENT DRIVE
        MOV     A,C                     ;INTO A
        STA     DRVPR                   ;PUT IT IN THE STRING
        CALL    ILPRT                   ;AND SHOW THE PROMPT
        DB      CR,LF,'['
DRVPR   DB      ' ]',' '+80H

        MVI B,BUFLEN ! MVI A,' ' ! LXI  H,CMDLIN
        CALL    FILL                    ;CLEAR OUT BUFFER

        MVI C,10 ! LXI D,BUFSIZ ! CALL BDOS ;GET STRING INTO BUFFER
PROCMD  LDA     CHRCNT                  ;HOW MANY CHARACTERS ENTERED?
        CPI 0 ! JZ GETLIN               ; IF ZERO HAVE AT IT AGAIN

;       +++     NOW PARSE COMMAND       +++

        LXI D,CMDLIN ! CALL ILCOMP
        DB      'FILE','S'+80H  ;IS IT DIRECTORY COMMAND?
        JZ      DIR             ;IF SO, DO IT
        CALL    ILCOMP
        DB      'CA','T'+80H    ;IS IT TYPE COMMAND
        JZ      TYPE            ;IF SO, DO IT
        CALL    ILCOMP
        DB      'HEL','P'+80H   ;IS IT HELP COMMAND?
        JZ      HELP            ;IF SO, DO IT
```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BeatNix for CP/M

```
        CALL    ILCOMP
        DB      'DRIV','E'+80H  ;IS IT CHANGE DIRECTORY?
        JZ      CDIR            ;IF SO, DO IT
                IF      DEBUG
        CALL    ILCOMP
        DB      'MO','N'+80H    ;IS IT MON?
        JZ      RESET           ;IF SO, DO IT
                ENDIF
        JMP     TRANS           ;TRY TRANSIENT COMMAND

        ;IF BAD TRANSIENT, COMES BACK HERE
UNCOOL  CALL CRLF ! LXI H,CHRCNT ! MOV B,M ! INX H
        CALL PRINT ! CALL ILPRT
        DB      ' is an uncool command','.'+80H
        JMP     GETLIN          ;AND GET NEW COMMAND

;----
;----   UTILITIES
;----
        IF      DEBUG
RESET:          ;DO DDT RESET
        CALL    CRLF            ;SHOW NEW LINE
        RST     7               ;BOP INTO DDT (NEAT, WHAT....)
        ENDIF

LOAD:           ;LOAD COM FILE INTO TPA
        CALL OPEN ! CPI 0FFH ! RZ ! LXI D,TPA   ;OPEN FILE
LOADL   PUSH D ! MVI C,26 ! CALL BDOS           ;SET DMA
        CALL READ ! POP D ! CPI 0 ! JNZ LOADN   ;READ SECTOR
        XCHG ! LXI D,128 ! DAD D ! XCHG         ;ADD 1 SECTOR
        JMP     LOADL           ;AND GET ANOTHER
LOADN   CALL CLOSE ! XRA A ! RET

CRLF:   CALL    ILPRT           ;SHOW NEW LINE ON TUBE
        DB      CR,LF+80H
        RET

CONOUT:                 ;SEND A TO TUBE
        MVI C,2 ! MOV E,A
        PUSH H ! PUSH D ! PUSH B ! CALL BDOS
        POP B ! POP D ! POP H ! RET

PAUSE:                  ;PAUSE FOR A KEY BASH
        CALL    ILPRT
        DB      CR,LF,'[ More ',']'+80H
WAIT    CALL CONSTAT ! CPI 0 ! JZ WAIT
        MVI A,CR ! CALL CONOUT ! CALL CONIN
        RET

CONSTAT:        ;GET CONSOLE STATUS
        MVI C,11 ! CALL BDOS ! RET

CONIN:          ;GET KEY BASH (NO ECHO)
        MVI C,6 ! MVI E,0FFH ! CALL BDOS
        CPI 0 ! JZ CONIN ! RET

ILPRT:  XTHL                    ;IN LINE PRINT
ILPLP   MOV A,M ! CPI 80H ! JP ILPEND ! CALL CONOUT
        INX H ! JMP ILPLP
ILPEND  ANI 7FH ! CALL CONOUT ! INX H ! XTHL ! RET

ILCOMP:         ;IN LINE COMPARE
        XTHL            ;GET POINTER TO STRING
        XCHG            ;GET POINTER IN D
        CMC             ;CLEAR CARRY
ILP     LDAX    D       ;GET CHARACTER FROM STRING
        CPI     80H
        JP      ILEND   ;IF END, QUIT
        CMP     M       ;COMPARE TO INPUT
        JNZ     NOCOMP  ;IF NO MATCH, SET FLAG
        INX     H
        INX     D       ;BUMP POINTERS AND LOOP
        JMP     ILP

NOCOMP  INX     D       ;BUMP POINTER
        LDAX    D       ;GET CHARACTER
        CPI     80H     ;LOOP 'TIL END
        JM      NOCOMP  ;FALL THROUGH TO END
        JMP     ILEND1  ;SKIP LAST COMPARE

ILEND   ANI     7FH
        CMP     M
ILEND1  XCHG            ;GET FIXED POINTER IN H
        INX     H       ;POINT TO NEXT INSTRUCTION
        XTHL            ;PUT POINTER BACK ON STACK
        RET

FIRST:          ;SEARCH FOR FIRST
        XRA A ! STA FCB+12 ! STA FCB+14 ! STA FCB+18 ;NULL OUT FCB
        MVI C,17 ! LXI D,FCB ! CALL BDOS ! RET

NEXT:           ;SEARCH FOR NEXT
        MVI C,18 ! LXI D,FCB ! CALL BDOS ! RET

SEEDR:          ;SHOW DRIVE
        MVI C,25 ! CALL BDOS ! ADI 1 ! STA FCB
        ADI DISKOFF ! STA DIRP ! CALL ILPRT
DIRP    DB      0,CR,LF+80H
        RET

SETDMA          ;POINT DMA TO 0080H
        MVI C,26 ! LXI D,DMA ! CALL BDOS ! RET

FILL:           ;FILL MEMORY WITH A CONSTANT
        MOV M,A ! INX H ! DCR B ! JNZ FILL ! RET

PRINT:          ;PRINT A BUFFER
        MOV A,M ! CALL CONOUT ! INX H ! DCR B
        JNZ PRINT ! RET

DRVCODE:        ;GET DRIVE CODE IN A, WITH OFFSET IN C
        MVI C,25 ! CALL BDOS ! MOV C,A ! ADI DISKOFF+1
        MOV C,A ! SUI DISKOFF ! RET

MOVE:           ;MOVE FROM H TO D, LENGTH IN B
        MOV A,M ! STAX D ! INX H ! INX D ! DCR B
        JNZ MOVE ! RET
FIXFCB:         ;GET COMAND LINE ARG INTO FCB
        ;FILL THE FCB WITH BLANKS
        MVI A,' ' ! MVI B,11 ! LXI H,FCB+1 ! CALL FILL

        ;ZERO THE DISK FIELD
        MVI A,0 ! STA FCB

        ;FIND THE SPACE BEFORE ARG
        LXI     H,CHRCNT                ;POINT TO CHARACTER COUNT
        MOV     B,M                     ;GET IT INTO B
        INX     H                       ;POINT TO START OF BUFFER
        MVI     A,' '                   ;LOOKING FOR SPACE

SPCSK   CMP M ! JZ SPCFND ! INX H ! DCR B
        JNZ SPCSK ! JMP NOARG                   ;CAN'T FIND START OF ARG

        ;FIND START OF ARG
SPCFND  INX H ! CMP M ! JNZ COMT ' DCR B
        JNZ SPCFND ! JMP NOARG

        ;COPY ARG INTO COMMAND TAIL
COMT    PUSH    H                       ;SAVE POINTER
        PUSH    PSW                     ;SAVE A
        LXI     D,DMA                   ;POINT INTO DMA
        DCX     H                       ;BACK TO SPACE
CMPTLP  MOV A,M ! STAX D ! INX H ! INX D ! MOV A,H
        CPI 0 ! JZ CMPTLP ! POP PSW ! POP H

        ;H NOW POINTS TO ARG, SEE IF DISK SPECIFIER
SPECIF  INX     H                       ;POINT TO NEXT CHAR
        MOV     A,M                     ;GET THE CHARACTER
        DCX     H                       ;PUT H BACK
        CPI     DISKSP                  ;IS IT DISK SPECIFIER?
        JNZ     ARGFND                  ;IF NOT, WE HAVE ARG
        MOV     A,M                     ;IF YES, GET DISK
        SUI     DISKOFF                 ;MASK OFF ASCII
        STA     FCB                     ;PUT IN FCB
        INX     H
        INX     H                       ;POINT TO REAL ARG

        ;GET NAME INTO FCB
        ;ALSO ENTRY POINT FOR TRANSIENTS
ARGFND  LXI     D,FCB+1                 ;POINT INTO FCB
        MOV     A,M                     ;GET FIRST CHAR IN ARG
        CPI     ' '                     ;IF IT'S A SPACE
        JZ      NOARG                   ;WHOLE FIELD IS WILD
        MVI     B,8                     ;OTHERWISE, GET FIELD LENGTH
ARGLP   MOV     A,M                     ;GET A BYTE
        CPI     '.'                     ;END OF NAME?
        JZ      DOTFND
        CPI     WILDCRD                 ;IS IT A WILD CARD?
        JNZ     SAVEIT                  ;IF NOT, DON'T DO ?'S
        PUSH    H
        MVI     A,'?'                   ;FILL FCB FIELD
        XCHG
        CALL    FILL
        POP H ! INX H
        JMP     DOTFND                  ;AND PROCEED WITH DOTFOUND

SAVEIT  STAX    D                       ;SAVE IT IN FCB
        INX     H
        INX     D
        DCR     B
        JNZ     ARGLP
        JMP     ALLMOV

        ;H NOW POINTS TO DOT, GET EXT INTO FCB
DOTFND  LXI     D,FCB+9                 ;POINT INTO FCB
        MVI     B,3
DOTLP   INX     H                       ;POINT H PAST DOT
```

```
        MOV     A,M                     ;GET BYTE
        CPI     WILDCRD                 ;IS IT WILD CARD
        JNZ     STAEX                   ;IF NOT, CARRY ON

        MVI     A,'?'                   ;GET WILD CHARACTER
        XCHG                            ;GET FCB POINTER IN H
        CALL    FILL                    ;FILL FCB
        JMP     ALLMOV

STAEX   STAX    D
        INX     D
        DCR     B
        JNZ     DOTLP

        ;ALL MOVING DONE
ALLMOV  XRA     A                       ;SHOW ARG WAS FOUND
        RET

NOARG   MVI     A,0FFH                  ;SHOW ARG WAS NOT FOUND
        RET

OPEN:           ;OPEN FILE IN FCB
        XRA A ! STA FCB+14 ! STA FCB+32 ! MVI C,15
        LXI D,FCB ! CALL BDOS ! RET

CLOSE:          ;CLOSE FILE IN FCB
        MVI C,16 ! LXI D,FCB ! CALL BDOS ! RET

READ:           ;READ IN A SECTOR
        MVI C,20 ! LXI D,FCB ! CALL BDOS ! RET

;----
;----   FUNCTIONAL CODE
;----

TYPE:           ;TYPE A FILE
        CALL    CRLF            ;NEW LINE
        XRA     A
        STA     LINCNT          ;ZERO LINE COUNT
        CALL    FIXFCB          ;FIX UP FCB
        CPI     0FFH
        JZ      GETLIN          ;SKIP IF NO ARGS
        CALL    OPEN            ;OPEN THE FILE
        CPI     255             ;SEE IF OPEN ERROR
        JZ      TYPERR
TYPE1   CALL    READ            ;READ A SECTOR
        CPI     0
        JNZ     TYPEND          ;QUIT IF END OF FILE

        MVI     B,128           ;GET SECTOR LENGTH
        LXI     H,DMA           ;POINT TO DMA BUFFER
TYPLP   MOV     A,M             ;GET A BYTE
        CPI     EOF             ;IS IT END OF FILE?
        JZ      TYPEND          ;IF SO, SCRAM
        CPI     LF              ;IS IT NEW LINE?
        JNZ     NOLF            ;IF NOT, NO BUMP

        PUSH    B               ;SAVE COUNTER
        PUSH    H               ;SAVE POINTER
        LDA     LINCNT          ;GET COUNT
        INR     A               ;INCREMENT COUNT
        STA     LINCNT          ;SAVE SOUNT
        CPI     SDEEP-1         ;READY FOR PAUSE?
        JNZ     SEELF           ;IF NOT, JUST DO NEW LINE
        CALL    PAUSE           ;DO THE PAUSE
        CPI     BRK
        JZ      TYPEND          ;QUIT IF CTRL C
        XRA     A               ;ZERO COUNT
        STA     LINCNT          ;SAVE COUNT
SEELF   MVI     A,LF            ;GET LF INTO A
        POP     H               ;GET POINTER BACK
        POP     B               ;RESTORE COUNTER

NOLF    CALL    CONOUT          ;SEND CHARACTER OUT
        INX     H               ;BUMP POINTER
        DCR     B               ;AND COUNTER
        JNZ     TYPLP           ;AND GO AGAIN
        JMP     TYPE1           ;OR GET NEXT SECTOR

TYPEND  CALL    CLOSE           ;CLOSE FILE
        JMP     GETLIN

TYPERR  CALL    ILPRT
        DB      CR,LF,'Tilt.',' '+80H
        MVI     B,11
        LXI     H,FCB+1
        CALL    PRINT           ;PRINT FILE NAME
        LDA     FCB             ;GET DRIVE CODE
        CPI     0               ;IF NOT AUTOSELECT
        JNZ     TYPESL          ;...SKIP CALL
        MVI     C,25            ;GET CURRENT DRIVE
        CALL    BDOS
        INR     A               ;FUDGE FOR CORRECTION

TYPESL  ADI     DISKOFF-1       ;ADD ASCII OFFSET
        STA     TYPED           ;PUT IN STRING
        CALL    ILPRT
        DB      'isn''t real on drive '
TYPED   DB      ' ','.'+80H
        JMP     GETLIN

DIR:            ;PRINT THE DIRECTORY
        MVI A,'?' ! MVI B,11 ! LXI H,FCB+1 ! CALL FILL

        CALL    FIXFCB          ;GET COMMAND ARGS TO FCB
        CPI     0
        JZ      NOWILD
        MVI     A,'?'
        MVI     B,11
        LXI     H,FCB+1
        CALL    FILL

NOWILD  LDA     FCB             ;GET DRIVE BYTE
        CPI     0               ;IF AUTOSELECT
        CZ      DRVCODE         ;GET DRIVE CODE
        ADI     DISKOFF         ;ADD ASCII OFFSET
        STA     DIRBY           ;SAVE IT IN LITTERAL
        CALL    ILPRT           ;SHOW THE LITTERAL
        DB      CR,LF,'Directory of drive '
DIRBY   DB      ' ','.',CR,LF+80H
        CALL    FIRST           ;GET FIRST MATCH
        CPI     0FFH            ;IF NO MATCH
        JZ      NOFILE          ;SAY SO
        CALL    SHFILE          ;ELSE SHOW FILE NAME
DIRLP   CALL    NEXT            ;GET NEXT MATCH
        CPI     0FFH            ;IF NO MATCH
        JZ      DIREND          ;ALL DONE
        CALL    SHFILE          ;ELSE SHOW FILE
        JMP     DIRLP           ;AND LOOP

NOFILE  CALL    ILPRT
        DB      'No file','s'+80H
```


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Computron

BeatNix for CP/M

```
DIREND  JMP     GETLIN          ;GET NEXT COMMAND

SHFILE:         ;SEE A FILE ENTRY
        LXI     H,DMA
        RLC ! RLC ! RLC ! RLC ! RLC
        LXI     D,0
        MOV     E,A
        DAD     D
        INX     H
        MVI     B,11
        CALL    PRINT
        CALL    ILPRT
        DB      '    ',' '+80H
        RET

CDIR:                   ;CHANGE DRIVES
        LDA     CMDLIN+6        ;GET ARG
        SUI     DISKOFF+1       ;MASK OFF ASCII
        CPI     MAXDSK          ;
        JP      GETLIN          ;
        MVI     C,14            ;SET UP FOR BDOS
        MOV     E,A             ;GET ARG INTO E
        CALL    BDOS
        JMP     GETLIN
                                ;
        JP      GETLIN          ;
        MVI     C,14            ;SET UP FOR BDOS
        MOV     E,A             ;GET ARG INTO E
        CALL    BDOS
        JMP     GETLIN

TRANS:                  ;RUN A TRANSIENT
        LXI H,FCB+1 ! MVI A,' ' ! MVI B,11 ! CALL FILL
        XRA A ! STA FCB         ;SET UP CLEAN FCB

        LXI     H,CMDLIN        ;MOVE NAME INTO FCB
        LXI     D,FCB+1
        MVI     B,8
TRANSB  MOV     A,M
        CPI     ' '
        JZ      TRANSA
        STAX    D
        INX     H
        INX     D
        DCR     B
        JNZ     TRANSB

TRANSA  LXI     H,COM   ;ADD COM TO END
        LXI     D,FCB+9
        MVI     B,3
        CALL    MOVE

        CALL    LOAD            ;LOAD MEMORY WITH FILE
        CPI     0               ;IF UNCOOL, SAY SO
        JNZ     UNCOOL

        CALL    FIXFCB          ;MAKE UP FCB FOR TRANSIENT
        CALL    CRLF            ;SHOW NEW LINE ON THE TUBE
        CALL    SETDMA          ;SET DMA TO 0080
        LXI     SP,TPA          ;SET STACK POINTER
        XRA     A               ;
        STA     CHRCNT          ;ZERO COMMAND POINTER
        IF      NOT DEBUG
        CALL    TPA             ;CALL TRANSIENT
        ENDIF
        JMP     CPR1            ;NEXT...

HELP:   CALL    ILPRT
        DB      26,9            ;CLEARS SCREEN & TAB
        DB      'BeatNix Version ',VERS+'0',SUBVERS+'0'
        DB      ' Copyright 1985 (c) Steve Rimmer',CR,LF
        DB      'The BeatNix operating system is a small console '
        DB      'command processor which is',CR,LF
        DB      'designed to have better karma and general '
        DB      'vibrations than those of more',CR,LF
        DB      'involved human interfaces. It features four '
        DB      'built in commands, to wit:',CR,LF,LF
        DB      9,9,9,'HELP',9,'Sorts out the lost.',CR,LF
        DB      9,9,9,'FILES',9,'Shows the directory.',CR,LF
        DB      9,9,9,'CAT',9,'Heaves files to the tube.',CR,LF
        DB      9,9,9,'DRIVE',9,'Changes drives.',CR,LF,LF
        DB      'The first drive is refered to as '
        DB      1+DISKOFF,DISKSP,'.',CR,LF,LF
        DB      '"It''s better to have a brain and not need it '
        DB      'than to need a brain',CR,LF
        DB      'and not have it."',CR,LF,9,9,9,9,9,9,9
        DB      '-Alonzo the Frog Farmer',CR,LF,LF+80H
        JMP     GETLIN

        DS      20
STACK   DS      2

ZZZEND  EQU     $-CCP           ;MUST BE LESS THAN 0800H

        END
```

De Bugs

The only other real mystery involved in BeatNix is the DEBUG equate. This is normally set FALSE, which produces a BeatNix that does what it's supposed to do.

Setting DEBUG TRUE will cause the program to generate a HEX file which can be run through LOAD to produce a runnable COM file. In other words, it ORGS at 0100H, just like any other program. This makes it a lot easier to develop new internal commands and such.

The DEBUG version of BeatNix also adds a command to the code, to wit, MON. It's intended to be used in conjunction with DDT. If you DDT BEATNIX.COM and then G0100 you'll find yourself in BeatNix. You can run any of the built in commands. If you try to run a transient it will load in at 8000H... don't try any really large transients... but it won't execute, for obvious reasons.

You can enter DDT any time you want to with the MON command. This finds DDT in a fairly obscure way by executing a RST 7 instruction. RST 7 leaps to a vector in low memory which DDT establishes for just this purpose. You can, as such, examine the results of whatever you caused BeatNix to do.

Having gotten BeatNix up and running in its current form you will probably want to hack with it. It sort of cries out with a plaintive wailing for enhancements and modifications. The only restriction in doing so is to be sure that the equate ZZZEND is less than 0800H... you can see it if you type BEATNIX.SYM. It's the last equate in the file. Dire things will happen if this value exceeds its station in life.

BeatNix can be a practical operating system if you are particularly dissatisfied with CP/M. However, it can also be a great way to learn about the internals of CP/M. It's a blistering programming challenge if you've become bored with writing three level chess programs and intelligent coffee pot controllers. **CN!**

Assembling Graphics on the PC

A few years ago you were probably unaware of what a pixel was, and were very pleased to be so. Now, mayhaps, they scramble about in the dark corners of your mind like the mice that live under your disk drives. Here's a look at some techniques for taming them with an assembler.

by Steve Rimmer

Of all of the sublime and cerebrally exalted endeavours of mankind, none has surpassed the wanton pleasure of slaughtering glowing blue aliens for sheer joy and amusement. I mean, what could be more enlightening, more exhilarating, more spiritually rewarding than staring at a tube going slowly blind while the little phosphor Martians bite it in a cloud of superheated pixels?

Everyone who answered "washing socks" can go back to watching Masterpiece Theatre. I'll be there in a moment as soon as I finish this article.

A good video game is usually hinged on surrealistic looking high resolution graphics. Unfortunately, many systems, while theoretically supporting such things, don't really give the common unwashed access to them to any great degree. High resolution stuff under BASIC is traditionally glacially slow, while handling it from assembler usually requires masses of tricky code.

Doing high resolution plotting at the assembler level on the IBM PC is not nearly as weird as it is on other systems, such as the Apple][+. The relationship of the pixels on the glass to the memory which holds them, while by no means simple, is none the less fathomable if you do enough drugs. More to the point, there is a system call which will do all the weird math for you, and smoke them pixels where ever you want 'em.

In this feature we're going to have a blast at the high resolution ROM BIOS routines and some of the techniques involved in using them.

Dancing Aliens

The program in listing one is not remarkably useful and only marginally entertaining as it stands. It is, in fact, a demonstration illustrating the use of the code involved in handling high resolution shapes.

As you will check out for yourself if you decide to expand the dancing aliens program into something practical, even trivial graphics programs involve massive amounts of code. It's probably been written down somewhere... and subsequently lost due to a disk error... that doubling the number of variables in a machine language program increases the complexity of the resultant code by a factor of ten.

When you run this program the first thing of any importance that it does is to set the screen to mode four, which is defined as being a graphics screen with three hundred and twenty by two hundred dots. The dots can each be any of four colours. The four colours, in turn, can be selected from two groups, or *palettes*.

The dots which turn up on the screen are held in the memory on the video card, starting in segment 0B800H. Each byte... a byte being eight bits... holds the information defining four dots. This will take a bit of a brain dance to figure out. Each dot can be one of four colours, which means that two bits can define it. Two bits can be in any of four unique states. Thus, four two–bit groups can live in one byte, and each byte holds four pixels.

The simplest and fastest way to do high resolution graphics, then, is to put the screen in a graphics mode and POKE the appropriate bits into the appropriate part of RAM. This works and, in fact, is how a lot of video games and other fast high resolution things do their stuff. However, while the code to do this is fairly straight up, figuring out how the bits are supposed to be arranged and where in the screen RAM they have to live is something of a party.

This being an introduction the sacred mysteries, we'll leave that particular ritual for another day.

There is some fine print in the 10H interrupt which will plot high resolution pixels. By comparison with the procedure of ham-

mering bytes into the screen RAM, this bit of code is trivially easy to handle. You put the horizontal position in the CX register, the vertical position in the DX register, the colour of the dot in AL... it has to be between zero and three... twelve in AH and throw the interrupt. Unless there is a troll in your computer or a monochrome display card in your peripheral section the dot will show up on the screen.

This is the heart of the dancing aliens program. It takes place in the PLOTDOT procedure. It could be replaced with a rather more complicated routine to figure out the bit position of the dot and thereupon AND and OR the screen memory... the code is about twenty lines long, and improves on the access time of the BIOS call by about half again. However, the intention in this thing was to keep the works fairly simple.

The ability to plot dots on the screen is not the end of the quest. BASIC offers quite a number of ways to handle this facility... the IBM's BIOS does not. Drawing a line, for example, involves writing the appropriate code as part of your program.

This program plots shapes on the screen. In a sense, it draws large characters using the BIOS plotting call, in much the same way that the BIOS plots ASCII characters when instructed to print something when the screen's in a graphic mode.

A shape can be any size, although the code to handle shapes larger than sixteen bits on a side becomes a bit more involved. Along these lines, it's desirable to have the size of the shape some even multiple of eight, as well.

The working of the shapes can be easily understood if you check out one of the shape tables at the top of the program. The stuff after the semi-colon in each line in ALIEN1, for example, is a binary representation of the sixteen bit entry in the table. There are sixteen entries in each table.

The code will scan the table one bit at a time. Each high bit will show up on the screen as a lit pixel. Each low bit will be a dark pixel... actually, a pixel turned on to the background colour. As you can see in the binary stuff, the bits represent the shapes of the aliens fairly clearly.

You can, in fact, do this directly by specifying the table entries in binary...

```
DW    007E99H
```

can also be represented as

```
DW    0000011111100000B
```

As such, you can create your own shape tables fairly quickly.

The Shape of Things

The SHAPE procedure is the most complex bit of the program. It decodes the shape table information and represents it as pixels on the screen.

While it is possible to handle all of the information passed between the various routines in registers, the resultant pops and

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pushes would take up a lot more room and a lot more time than does using memory stashes for the passed parameters. As such, all of the information passed to the SHAPE routine is stored in the appropriate buffers before it's called, and it, in turn, sucks out what it needs.

It isn't all that apparent when you look at it, but SHAPE consists of two nested loops, analogous to FOR NEXT loops in BASIC. It can be seen as

```
110 'SHAPE PROCEDURE
120 C = XPOS
130 D = YPOS
140 B = SHAPE.LOCATION
150 T = C
160 FOR Y = 1 TO 16
170     S = SHAPE(Y)
180     FOR X = 1 TO 16
190         'SET FLAG FOR DARK PIXEL
200         'SEE IF BIT X IS SET
210         'IF IT IS, SET FLAG FOR LIGHT PIXEL
220         GOSUB PLOTDOT
230     NEXT X
240 NEXT Y
```

This part of the code is what puts the sixteen bit ceiling on simple shapes. It is, however, what makes the works fairly uncomplicated for shapes within this range. The 8088 can manipulate sixteen bits as one word. We can have it check the status of any bit... or combination of bits... in a register by setting them high in another register and using the TEST instruction. TEST performs a non-destructive AND. If the test is successful... that is, if the bits match... the Z flag will be low.

The inner loop of the SHAPE procedure starts with the line of the shape in AX and BX setup with its highest bit set and all the others unset... this corresponds to 8000H. It tests AX against BX. If the highest bit of AX is set it signals PLOTDOT to plot a lighted pixel. Otherwise it will plot a background pixel.

```
        COMMENT /

        *** Watch the dancing aliens ***

        Sample code for the use of the ROM BIOS
        high resolution dot plotter and bit shapes
        for the IBM PC

        Copyright 1985 (c) Steve Rimmer

        "That not busy being worn is busy drying"
                                        -Dylan

        /

CODEX   SEGMENT
MAIN    PROC    FAR
        ASSUME  CS:CODEX
        ORG     0100H   ;START OF TPA
START:  JMP     BEGIN   ;LEAP OVER FIXED BYTES

;       THIS BE THE ALIEN, ME BUCKOS
ALIEN1: DW      00000H  ;0000000000000000
        DW      00000H  ;0000000000000000
        DW      007E0H  ;0000011111100000
        DW      00FF0H  ;0000111111110000
        DW      01FF8H  ;0001111111111000
        DW      01DB8H  ;0001110110111000
        DW      00FF0H  ;0000111111110000
        DW      00660H  ;0000011001100000
        DW      00BD0H  ;0000101111010000
        DW      01188H  ;0001000110001000
        DW      02244H  ;0010001001000100
        DW      04002H  ;0100000000000010
        DW      02004H  ;0010000000000100
        DW      01008H  ;0001000000001000
        DW      00810H  ;0000100000010000
        DW      00000H  ;0000000000000000

ALIEN2: DW      00000H  ;0000000000000000
        DW      00000H  ;0000000000000000
        DW      007E0H  ;0000011111100000
        DW      00FF0H  ;0000111111110000
        DW      01FF8H  ;0001111111111000
        DW      01DB8H  ;0001110110111000
        DW      00FF0H  ;0000111111110000
        DW      00660H  ;0000011001100000
        DW      00BD0H  ;0000101111010000
        DW      01188H  ;0001000110001000
        DW      01248H  ;0001001001001000
        DW      00810H  ;0000100000010000
        DW      00420H  ;0000010000100000
        DW      00240H  ;0000001001000000
        DW      00420H  ;0000010000100000
        DW      00000H  ;0000000000000000

SHAPNT: DW      0000H   ;BUFFER FOR SHAPE POINTER
XPOS:   DW      0000H   ;BUFFER FOR X DOT POSITION
YPOS:   DW      0000H   ;BUFFER FOR Y DOT POSITION
COLOUR: DW      0000H   ;BUFFER FOR COLOUR
XSTSH:  DW      0000H   ;BUFFER FOR LEFT MARGIN
DOTON:  DW      0000H   ;BUFFER FOR DOT COLOUR
DOTOFF: DW      0000H   ;BUFFER FOR BACKGROUND COLOUR
ADIR:   DW      0001H   ;BUFFER FOR DIRECTION

BEGIN:  CALL    CLRSCRN ;CLEAR DE GLASS
        CALL    GRMODE  ;SET GRAPHICS MODE

        CALL    ILPRT
        DB      'The dance of the stoned out aliens',13,10
        DB      '[ Hit the space bar to stop the party ]',0

        MOV     [XPOS],20               ;SET INITIAL X POSITION
        MOV     [YPOS],50               ;SET INITIAL Y POSITION
        MOV     [DOTOFF],0000H          ;SET BACKGROUND COLOUR
        MOV     [DOTON],0001H           ;SET FOREGROUND COLOUR
        MOV     BX,OFFSET ALIEN1        ;POINT TO FIRST ALIEN
        MOV     [SHAPNT],BX             ;POINT TO ALIEN 1

NEWSHP: CALL    SHAPE                   ;DISPLAY CURRENT SHAPE
        MOV     AH,1                    ;SEE IF THERE'S A KEYPRESS
        INT     16H
        JZ      NOKEY                   ;IF NOT, DON'T GET LOST
        CMP     AL,20H
        JE      EXIT

NOKEY:  MOV     AX,[XPOS]               ;GET PRESENT POSITION
        CMP     AX,290                  ;IS IT RIGHT EDGE?
        JE      GOLEFT                  ;IF SO, REVERSE
        CMP     AX,2                    ;IS IT LEFT EDGE
        JE      GORITE                  ;IF SO, REVERSE
        MOV     BX,[ADIR]               ;GET THE DIRECTION
        ADD     AX,BX                   ;ADD IT TO THE OLD POSITION
        MOV     [XPOS],AX               ;AND UPDATE MEMORY

SWAPAL: MOV     AX,[SHAPNT]             ;GET THE ALIEN POINTER
        MOV     BX,OFFSET ALIEN1        ;GET LOCATION OF FIRST ALIEN
        CMP     AX,BX                   ;SEE IF THEY MATCH
        JE      SETAL2                  ;IF SO, POINT TO SECOND ALIEN
        MOV     [SHAPNT],BX             ;IF NOT, POINT TO FIRST ALIEN
        JMP     NEWSHP                  ;AND DO NEW SHAPE
SETAL2: MOV     BX,OFFSET ALIEN2;       ;POINT TO FIRST ALIEN
        MOV     [SHAPNT],BX             ;GET IT INTO MEMORY
        JMP     NEWSHP                  ;AND GO DO SHAPE

GOLEFT: MOV     AX,OFFFFH               ;CHANGE DIRECTION TO -1
        MOV     [ADIR],AX               ;PUT IT IN MEMORY
        DEC     [XPOS]                  ;MOVE ALIEN 1 LEFT
        JMP     NEWSHP                  ;AND DO NEW SHAPE

GORITE: MOV     AX,0001H                ;CHANGE DIRECTION TO +1
        MOV     [ADIR],AX               ;PUT IT IN MEMORY
        INC     [XPOS]                  ;MOVE ALIEN 1 RIGHT
        JMP     NEWSHP                  ;AND DO NEW SHAPE

EXIT:   CALL    TXMODE                  ;RESTORE SCREEN
        INT     20H                     ;BACK TO DOS

MAIN    ENDP

;       +++ UTILITY SUBMARINES +++

TXMODE  PROC    NEAR    ;SET SCREEN TO 80 X 25 TEXT
        MOV     AL,2
        MOV     AH,0
        INT     10H
        RET
TXMODE  ENDP

GRMODE  PROC    NEAR    ;SET SCREEN TO 320 X 200 GRAPHICS
        MOV     AL,4
        MOV     AH,0
```

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```
        INT     10H
        RET
GRMODE  ENDP

PLOTDOT PROC    NEAR            ;PLOT A DOT ON THE TUBE
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX              ;SAVE ALL RESISTERS
        MOV     AX,[COLOUR]     ;GET THE COLOUR
        MOV     CX,[XPOS]       ;GET THE HORIZONTAL POS
        MOV     DX,[YPOS]       ;GET THE VERTICAL POS
        MOV     AH,12           ;SET UP FOR CALL
        INT     10H             ;FIRE PHASORS, SCOTTY
        POP     DX
        POP     CX
        POP     BX
        POP     AX              ;RESTORE REGISTERS
        RET
PLOTDOT ENDP

SHAPE   PROC    NEAR            ;SHOW SHAPE ON TUBE
        MOV     CX,[XPOS]       ;GET X POSITION
        MOV     DX,[YPOS]       ;GET Y POSITION
        MOV     BX,[SHAPNT]     ;GET SHAPE POINTER
        PUSH    BX              ;SAVE ALL USEFUL POINTERS
        PUSH    CX
        PUSH    DX
        MOV     [XSTSH],CX      ;SAVE X POSITION FOR INTERNALS

        MOV     CX,16           ;VERTICAL POSITION LOOP
WDTEST: PUSH    CX              ;SAVE IT (OUTER LOOP)

        MOV     BX,[SHAPNT]     ;POINT TO SHAPE
        MOV     AX,[BX]         ;GET FIRST WORD IN AX
        MOV     BX,8000H        ;GET HIGH BIT OF BX SET

        MOV     CX,16           ;HORIZONTAL POSITION LOOP
BITEST: PUSH    CX              ;SAVE IT (INNER LOOP)
        MOV     DX,[DOTOFF]     ;SET DOT OFF
        TEST    BX,AX           ;SEE IF BIT IS HIGH
        JZ      NOBIT           ;IF NOT, LEAVE DOT OFF
        MOV     DX,[DOTON]      ;ELSE TURN DOT ON
NOBIT:  MOV     [COLOUR],DX     ;STASH DOT COLOR
        CALL    PLOTDOT         ;PLOT DOT AT CURRENT POSITION
        ROR     BX,1            ;MOVE TEST FLAG DOWN ONE
        INC     XPOS            ;INCREMENT X LOCATION POINTER
        POP     CX              ;GET COUNTER (INNER LOOP)
        LOOP    BITEST          ;AND LOOP 'TIL DONE

        INC     [SHAPNT]        ;POINT INTO NEXT WORD OF SHAPE
        INC     [SHAPNT]        ;2 INC'S, 'COZ IT'S 16 BITS

        MOV     CX,[XSTSH]      ;MOVE X LOCATION BACK TO START OF LINE
        MOV     [XPOS],CX

        INC     [YPOS]          ;INCREMENT Y POSITION

        POP     CX              ;GET COUNTER (OUTER LOOP)
        LOOP    WDTEST          ;LOOP 'TIL DONE

        POP     DX
        POP     CX
        POP     BX              ;RESTORE STACK
        MOV     [SHAPNT],BX     ;RESTORE SHAPE POINTER
        MOV     [YPOS],DX       ;PRESERVE INITIAL STARTING
        MOV     [XPOS],CX       ;POSITIONS

        RET
SHAPE   ENDP

CLRSCRN PROC    NEAR            ;CLEAR THE SCREEN
        MOV     CX,0
        MOV     BH,7
        MOV     DH,24
        MOV     DL,79
        MOV     AL,0
        MOV     AH,6
        INT     10H
        MOV     DX,0
        CALL    POSIT           ;HOME CURSOR
        RET
CLRSCRN ENDP

ILPRT   PROC    NEAR            ;IN LINE PRINT
        POP     BX              ;SEE FEB 85 CN!
ILPLP:  MOV     DL,[BX]
        CMP     DL,0
        JE      ILPRET
        MOV     AH,2
        PUSH    BX
        INT     21H
        POP     BX
        INC     BX
        JMP     ILPLP
ILPRET: INC     BX
        PUSH    BX
        RET
ILPRT   ENDP

POSIT   PROC    NEAR            ;SET CURSOR POSITION
        MOV     AH,15
        INT     10H
        MOV     AH,2
        INT     10H
        RET
POSIT   ENDP

CODEX   ENDS
;
        END     START
```

All of the pixels in a shape are plotted, lit or not. This makes moving the shapes fairly easy. The outermost pixel along all four borders of the shapes is dark, so that, so long as the shape is moved in one pixel increments, it will always erase the previous shape.

Having plotted a pixel, SHAPE rotates the BX register one place right, which moves the high bit down one, and tests it against AX again. If it does this a total of sixteen times... once for each bit in the word... it will turn up all the lit pixels.

Aside from deciding which pixels should be lit, SHAPE must also determine where they should go. Plotting a single line is fairly straight up... we just increment the XPOS pointer with each successive pixel. However, upon moving to the next line... the next word in the table... the pointer must be returned to the left edge of the shape. We could just subtract sixteen from it, but it's equally simple to have stored the original value in a buffer... XSTSH in this case... and thereafter restore it.

It's important to realize that SHAPE will display any sixteen words... thirty two bytes... as a shape on the screen. It can do some first rate abstract art of you have it point at some code. This is a good trip, as it allows one to change what the shape will look like instantaneously by simply changing the pointer in SHAPNT. In this example, there are two tables for the alien. It appears to move its legs by flipping back and forth between the tables.

Masterpiece Theater Awaits

If you run this program for any video game freaks you happen to know you probably won't impress them... a blue alien skitters back and forth across the screen. Hit the space bar and it vanishes. The action will keep many users amused for seconds.

Having worked out the mechanism for handling high resolution images, however, you should be able to expand this simple code into some really serious programming. Not only will you be able to kill aliens, but intelligent gas clouds, lizard princesses, cosmic star fighters and the ever popular half mad green Toyotas from the caves of the nether reaches. That last one has a lot of potential. Blasting Toyotas into their component molecules is something almost anyone can relate to. **CN!**

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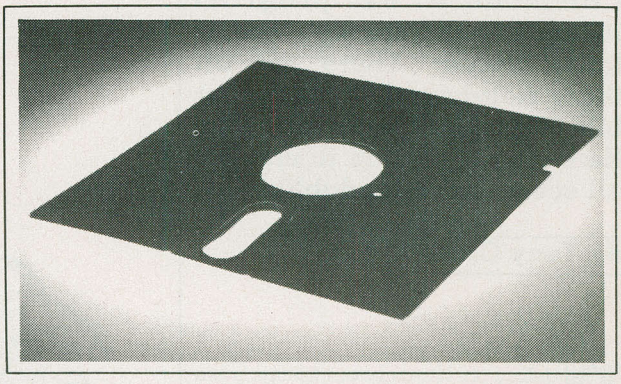

We've heard tell of many of our readers braving snapping winter frosts and slushy spring sidewalks just to pick up copies of their favourite Canadian magazines. The rumours appear to be true, and every time there's an influenza epidemic, the Board of Health raises their eyebrows at us.

Fortunately, there's an alternative to all this human suffering... and a very good one, indeed.

If you subscribe... or extend your subscription... to Computing Now!, Software Now! or Electronics Today magazine *before the May issues go to press*, we'll not only send you the best in Canadian publishing every month at a substantial savings over newsstand prices, but we'll also send you some software to keep you indoors... away from the cold and the viruses.

The Completely Free Software Disk is actually two disks in one. One side has a plethora of Apple DOS programs, and the other side is laden with IBM files. Blessed are the subscribers with access to both computers...

As its title implies, the Completely Free Software Disk is just that... **FREE**. However, it's only being offered to readers subscribing now or subscribers extending their present subscriptions, and only for a limited time. We regret that we'll be unable to supply the Completely Free Software Disk as a subscription bonus to orders postdated after **May 1, 1985**, so please subscribe or extend your subscription today to avoid disappointment.

Side One: Apple DOS files

Apple Binary Encryption and Apple Binary Decryption, with source files: Programs to keep peering eyes from your valuable data. See the article in the February 1985 issue of CN!.

Racquel.Pic: An Apple HiRes implementation of the CP/M teletype drawing offered in Almost Free Software Volume II.

HGR Dump: A BASIC editor that lets you preselect options before sending your HiRes picture to the printer. Written for a Dumpling-GX card, but easily modified.

HGR Invert: A fast binary program that displays the 'negative' of any HiRes picture in memory. BRUNning it again restores the picture.

Magfiler: A magazine article database in Applesoft BASIC. The February issue of CN! has already been entered to get you started.

Miniature Golf: A binary HiRes game of golf, with a truly wicked course. The sixth hole's a dandy.

Memtest: This short, two-sector binary program comes in handy when your Apple starts to hiccough. It writes and reads to memory from $0800 to $BFFF. Three passes and your RAM's in fine shape.

Forced Read, with source: A short binary program originally appearing in Electronics Today, this program has incredible error handling.

APCP/M: A handy utility for the Applesoft user who also dabbles in CP/M, this program will read a text file up to 16K in length from an Apple CP/M disk and write it to a DOS disk. Known affectionately as 'Reverse APDOS'.

DM II: From the Apple User Group of Sweden comes forth this DOS modifying program that allows you to change commands, error messages, catalog headers and volumes, and even fiddle with DOS entry points.

Star Patrol: An Applesoft implementation of the HiRes ADAM program appearing in the February edition of CN!. Your mission is to shoot elusive space bats.

Attenuators: An Applesoft BASIC program to aid calculating resistance and loss.

Capacitors: A similarly Applesoft BASIC program to help calculate capacitance and frequency response.

Side Two: IBM files

SD: An acronym for Sorted Directory, this program produces a more visually appealing directory than can be had from the MS-DOS DIR command.

FORTH: A small BASIC implementation of FORTH. You can expand the primitives or add new ones as they become necessary.

Datafile: Everyone needs a database manager. This one's written in Microsoft BASIC.

Blueterm, with source: A terminal program for the PC. Suggested hardware requirements include a modem...

Poker!: A BASIC program pitting you against your PC. Where's that straight flush when you need it?

Bandit: An alternative to that Las Vegas trip you've been planning. Appearing in the June issue of CN!, this BASIC program simulates a one-armed bandit.

CalcNOW!: A spreadsheet program written in BASIC. While very good at what it does, we don't expect Lotus to be nervous.

Cashacc: Written in BASIC, this is a cash acquisition and limited accounting package for the PC.

UnWS, with source: When you TYPE a WordStar file, you usually get garbage. This program strips the high bits from the WS file of your choice to make it legible again.

Note: Neither the Apple nor the IBM disk sides are bootable. Both Apple DOS 3.3 and MS-DOS are copyrighted disk operating systems, property of (respectively) Apple Computers Incorporated and Microsoft Corporation. In order to read the files on the Completely Free Software Disk, first boot a disk with either DOS 3.3 or MS-DOS on it, then either CATALOG or DIR the side that's relevant to your machine. From this point, you'll be able to run the applications programs, though it's suggested that you copy the files onto another disk.

All of the programs appearing on the Completely Free Software Disk have either been written in-house, or are believed to be in the public domain.

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Commodore List Debugger

It's hard to know what to call a Commodore 64 program listing... but "freaky" seems fairly decent. There are all those weird symbols and other bits of graphics paraphernalia. Here's a bit of code to make it all seem understandable.

By Tony Cross

Printing out Commodore listings is like printing out anything else on a computer... except for those unusual graphics characters. These can be a bit of a problem. They drive the printer quite satisfactorily... if you have a Commodore printer... but only the most proficient Commodore users can decipher them.

If you like to keep hard copy listings of your programs... or you want to give your printouts to friends and other people silly enough to want to figure out what they do... strings of inverse control symbols will probably prove pretty untractable.

You can, of course, write in the corrections by hand. However, this article features a machine language listing for the Commodore 64 which does all the work for you. List a program to the printer with it in place and all those cryptic control codes will turn up in somewhat plain English.

It sounds like a miracle, and well it should.

```
 10 033C          !*************************************
 20 033C          !*                                   *
 30 033C          !*                                   *
 40 033C          !*                                   *
 50 033C          !* V 2.0 -- FOR CENTRONICS PRINTER   *
 60 033C          !*                                   *
 70 033C          !*  COPYRIGHT (C)  A.L.CROSS 1984    *
 80 033C          !*                                   *
 90 033C          !*************************************
100 033C          !
110 033C          !
120 C000          *=$C000
130 C000          !
140 C000          !
150 C000 4C63C2 ENTRY       JMP BEGIN
160 C003          !
170 C003          !
180 C003          !SYSTEM VARIABLES
190 C003          !
200 C003          TXTTAB    =  $2B
210 C003          TXTPTR    =  $7A
220 C003          TABPTR    =  $FD
230 C003          BUFOFF    =  TABPTR
240 C003          BUSY      =  TABPTR
250 C003 0000     LNKPTR    WOR $0000
260 C005 00       QOTFLG    BYT $00
270 C006 00       COLFLG    BYT $00
280 C007 00       REMFLG    BYT $00
290 C008 00       CTLCHR    BYT $00
300 C009 00       BUFPTR    BYT $00
310 C00A 00       LINLEN    BYT $00
320 C00B 00       NUMCHR    BYT $00
330 C00C 00       SPCNUM    BYT $00
340 C00D 00       WIDTH     BYT $00
350 C00E          !
360 C00E          !
370 C00E          !VARIOUS EQUATES
380 C00E          !
390 C00E          USR       =  $0311
400 C00E          ERROR     =  $A437
410 C00E          POSINT    =  $B7F7
420 C00E          FPR1      =  $61
430 C00E          TYPE      =  $0D
440 C00E          NMTYPE    =  $0E
450 C00E          WORD      =  $0F    !MAX WORD LENGTH
460 C00E          OUTDOUT   =  $BC49
470 C00E          CVTSTG    =  $BDDF
480 C00E          GETSTG    =  $B487
490 C00E          DALSTG    =  $B6A6
500 C00E          RESWDS    =  $A09E
510 C00E          OLDNMI    =  $FE47
520 C00E          NMIVEC    =  $0318
530 C00E          PA2       =  $DD00
540 C00E          PORT      =  $DD01
550 C00E          PA2DDR    =  $DD02
560 C00E          DDR       =  $DD03
570 C00E          FLAG      =  $DD0D
580 C00E          !
590 C00E          !
600 C00E          !PRINT BUFFER AREA
610 C00E          !
620 C00E          BUFFER    =  *
630 C10E          *=*+256
640 C10E          !
650 C10E          !
660 C10E          !GRAPHICS/CONTROL CODES TABLE
670 C10E          !
680 C10E 93434C CTLTAB    BYT $93,'C,'L,'S+$80
690 C111 134B4F           BYT $13,'H,'O,'M+$80
700 C115 9D43CC           BYT $9D,'C,'L+$80
710 C119 1D43D2           BYT $1D,'C,'R+$80
720 C11C 9143D5           BYT $91,'C,'U+$80
730 C11F 1143C4           BYT $11,'C,'D+$80
740 C122 125245           BYT $12,'R,'E,'V+$80
750 C126 924F46           BYT $92,'O,'F,'F+$80
760 C12A 205350           BYT $20,'S,'P,'C+$80
770 C12E 8546B1           BYT $85,'F,'1+$80
780 C131 8646B3           BYT $86,'F,'3+$80
790 C134 8746B5           BYT $87,'F,'5+$80
800 C137 8846B7           BYT $88,'F,'7+$80
810 C13A 8946B2           BYT $89,'F,'2+$80
820 C13D 8A46B4           BYT $8A,'F,'4+$80
830 C140 8B46B6           BYT $8B,'F,'6+$80
840 C143 8C46B8           BYT $8C,'F,'8+$80
850 C146 904354           BYT $90,'C,'T,'L,'1+$80
860 C14B 054354           BYT $05,'C,'T,'L,'2+$80
870 C150 1C4354           BYT $1C,'C,'T,'L,'3+$80
880 C155 9F4364           BYT $9F,'C,'T,'L,'4+$80
890 C15A 9C4354           BYT $9C,'C,'T,'L,'5+$80
900 C15F 1E4354           BYT $1E,'C,'T,'L,'6+$80
910 C164 1F4354           BYT $1F,'C,'T,'L,'7+$80
920 C169 9E4354           BYT $9E,'C,'T,'L,'8+$80
930 C16E C0473E           BYT $C0,'G,'>,'@+$80
940 C172 C1473E           BYT $C1,'G,'>,'A+$80
950 C176 C2473E           BYT $C2,'G,'>,'B+$80
960 C17A C3473E           BYT $C3,'G,'>,'C+$80
970 C17E C4473E           BYT $C4,'G,'>,'D+$80
980 C182 C5473E           BYT $C5,'G,'>,'E+$80
990 C186 C6473E           BYT $C6,'G,'>,'F+$80
1000 C18A C7473E          BYT $C7,'G,'>,'G+$80
1010 C18E C8473E          BYT $C8,'G,'>,'H+$80
1020 C192 C9473E          BYT $C9,'G,'>,'I+$80
1030 C196 CA473E          BYT $CA,'G,'>,'J+$80
1040 C19A CB473E          BYT $CB,'G,'>,'K+$80
1050 C19E CC473E          BYT $CC,'G,'>,'L+$80
1060 C1A2 CD473E          BYT $CD,'G,'>,'M+$80
1070 C1A6 CE473E          BYT $CE,'G,'>,'N+$80
1080 C1AA CF473E          BYT $CF,'G,'>,'O+$80
1090 C1AE D0473E          BYT $D0,'G,'>,'P+$80
1100 C1B2 D1473E          BYT $D1,'G,'>,'Q+$80
1110 C1B6 D2473E          BYT $D2,'G,'>,'R+$80
1120 C1BA D3473E          BYT $D3,'G,'>,'S+$80
1130 C1BE D4473E          BYT $D4,'G,'>,'T+$80
1140 C1C2 D5473E          BYT $D5,'G,'>,'U+$80
1150 C1C6 D6473E          BYT $D6,'G,'>,'V+$80
1160 C1CA D7473E          BYT $D7,'G,'>,'W+$80
1170 C1CE D8473E          BYT $D8,'G,'>,'X+$80
1180 C1D2 D9473E          BYT $D9,'G,'>,'Y+$80
1190 C1D6 DA473E          BYT $DA,'G,'>,'Z+$80
1200 C1DA DB473E          BYT $DB,'G,'>,'++$80
1210 C1DE DC473C          BYT $DC,'G,'<,'-+$80
1220 C1E2 DD473E          BYT $DD,'G,'>,'-+$80
1230 C1E6 DF473C          BYT $DF,'G,'<,'*+$80
1240 C1EA A1473C          BYT $A1,'G,'<,'K+$80
1250 C1EE A2473C          BYT $A2,'G,'<,'I+$80
1260 C1F2 A3473C          BYT $A3,'G,'<,'T+$80
1270 C1F6 A4473C          BYT $A4,'G,'<,'@+$80
1280 C1FA A5473C          BYT $A5,'G,'<,'G+$80
1290 C1FE A6473C          BYT $A6,'G,'<,'++$80
1300 C202 A7473C          BYT $A7,'G,'<,'M+$80
1310 C206 A8473C          BYT $A8,'G,'<,'£+$80
1320 C20A A9473E          BYT $A9,'G,'>,'£+$80
1330 C20E AA473C          BYT $AA,'G,'<,'N+$80
1340 C212 AC473C          BYT $AC,'G,'<,'D+$80
1350 C216 AD473C          BYT $AD,'G,'<,'Z+$80
1360 C21A AE473C          BYT $AE,'G,'<,'S+$80
1370 C21E AF473C          BYT $AF,'G,'<,'P+$80
1380 C222 B0473C          BYT $B0,'G,'<,'A+$80
1390 C226 B1473C          BYT $B1,'G,'<,'E+$80
1400 C22A B2473C          BYT $B2,'G,'<,'R+$80
1410 C22E B3473C          BYT $B3,'G,'<,'W+$80
1420 C232 B4473C          BYT $B4,'G,'<,'H+$80
1430 C236 B5473C          BYT $B5,'G,'<,'J+$80
1440 C23A B6473C          BYT $B6,'G,'<,'L+$80
1450 C23E B7473C          BYT $B7,'G,'<,'Y+$80
1460 C242 B8473C          BYT $B8,'G,'<,'U+$80
1470 C246 B9473C          BYT $B9,'G,'<,'O+$80
1480 C24A BA473E          BYT $BA,'G,'>,'@+$80
1490 C24E BB473C          BYT $BB,'G,'<,'F+$80
1500 C252 BC473C          BYT $BC,'G,'<,'C+$80
1510 C256 BD473C          BYT $BD,'G,'<,'X+$80
1520 C25A BE473C          BYT $BE,'G,'<,'V+$80
1530 C25E BF473C          BYT $BF,'G,'<,'B+$80
1540 C262 00              BYT $00   !END OF TABLE
1550 C263          !
1560 C263          !
1570 C263          !
1580 C263          !
1590 C263          !PROGRAM INITIALISATION
1600 C263          !
```

```
1610 C263 A96E   BEGIN       LDA #<START
1620 C265 8D1103             STA USR
1630 C268 A9C2               LDA #>START
1640 C26A 8D1203             STA USR+1
1650 C26D 60                 RTS
1660 C26E        !
1670 C26E        !
1680 C26E        !MAIN PROGRAM START
1690 C26E        !
1700 C26E 20F7B7 START       JSR POSINT
1710 C271 A515               LDA $15
1720 C273 F005               BEQ GETNUM
1730 C275 A20E   QTYERR      LDX #$0E
1740 C277 4C37A4             JMP ERROR
1750 C27A A514   GETNUM      LDA $14
1760 C27C C910               CMP #$10
1770 C27E 90F5               BCC QTYERR
1780 C280 8D0DC0             STA WIDTH
1790 C283        !
1800 C283        !
1810 C283        !INITIALISE ALL POINTERS
1820 C283        !
1830 C283 A52B               LDA TXTTAB
1840 C285 8D03C0             STA LNKPTR
1850 C288 A52C               LDA TXTTAB+1
1860 C28A 8D04C0             STA LNKPTR+1
1870 C28D A900               LDA #$0
1880 C28F 8D0EC0             STA SPCNUM
1890 C292        !
1900 C292        !
1910 C292        !LOOP ONCE FOR EACH PROGRAM LINE
1920 C292        !
1930 C292 A900   MAINLP      LDA #$0
1940 C294 8D05C0             STA QOTFLG
1950 C297 8D09C0             STA BUFPTR
1960 C29A 8D07C0             STA REMFLG
1970 C29D 8D06C0             STA COLFLG
1980 C2A0        !
1990 C2A0        !
2000 C2A0        !INITIALISE THE PRINT BUFFER
2010 C2A0        !
2020 C2A0 A8                 TAY
2030 C2A1 990EC0 BUFINT      STA BUFFER,Y
2040 C2A4 C8                 INY
2050 C2A5 D0FA               BNE BUFINT
2060 C2A7        !
2070 C2A7        !
2080 C2A7        !SET UP TXTPTR FOR THIS LINE
2090 C2A7        !
2100 C2A7 AD03C0             LDA LNKPTR
2110 C2AA 85FB               STA TXTPTR

2120 C2AC AD04C0             LDA LNKPTR+1
2130 C2AF 85FC               STA TXTPTR+1
2140 C2B1        !
2150 C2B1        !
2160 C2B1        !SET UP LNKPTR FOR NEXT LINE
2170 C2B1        !
2180 C2B1 B1FB               LDA (TXTPTR),Y
2190 C2B3 8D03C0             STA LNKPTR
2200 C2B6 C8                 INY
2210 C2B7 B1FB               LDA (TXTPTR),Y
2220 C2B9 8D04C0             STA LNKPTR+1
2230 C2BC        !
2240 C2BC        !
2250 C2BC        !IF HIGH POINTER BYTE IS NULL
2260 C2BC        !THEN END OF PROGRAM REACHED
2270 C2BC        !
2280 C2BC C900               CMP #$0
2290 C2BE D009               BNE LIST
2300 C2C0 A900               LDA #$0
2310 C2C2 8561               STA FPA1
2320 C2C4 850D               STA TYPE
2330 C2C6 850E               STA NMTYPE
2340 C2C8 60                 RTS
2350 C2C9        !
2360 C2C9        !
2370 C2C9        !GET LINE NUMBER AND PRINT IT
2380 C2C9        !
2390 C2C9 C8     LIST        INY
2400 C2CA B1FB               LDA (TXTPTR),Y
2410 C2CC 8563               STA FPA1+2
2420 C2CE C8                 INY
2430 C2CF B1FB               LDA (TXTPTR),Y
2440 C2D1 8562               STA FPA1+1
2450 C2D3 98                 TYA
2460 C2D4 48                 PHA
2470 C2D5 208EC4             JSR CVTNUM
2480 C2D8 48                 PHA
2490 C2D9 AA                 TAX
2500 C2DA A920   SPCLP       LDA #$20
2510 C2DC E005               CPX #$05
2520 C2DE F007               BEQ SPCEND
2530 C2E0 20AAC4             JSR PRINT
2540 C2E3 E8                 INX
2550 C2E4 38                 SEC
2560 C2E5 B0F3               BCS SPCLP
2570 C2E7 68     SPCEND      PLA
2580 C2E8 AA                 TAX
2590 C2E9 209EC4             JSR PRTNUM
2600 C2EC        !
2610 C2EC        !
2620 C2EC        !ADD IN FOR/NEXT INDENT

2630 C2EC        !
2640 C2EC AE0CC0             LDX SPCNUM
2650 C2EF F00A               BEQ NOSPC
2660 C2F1 A920               LDA #$20
2670 C2F3 48     SPCLOP      PHA
2680 C2F4 20AAC4             JSR PRINT
2690 C2F7 68                 PLA
2700 C2F8 CA                 DEX
2710 C2F9 D0F8               BNE SPCLOP
2720 C2FB 68     NOSPC       PLA
2730 C2FC A8                 TAY
2740 C2FD        !
2750 C2FD        !
2760 C2FD        !LOOP FOR EACH BYTE IN THE LINE
2770 C2FD        !
2780 C2FD C8     LINELP      INY
2790 C2FE B1FB               LDA (TXTPTR),Y
2800 C300 D006               BNE NOTNUL
2810 C302        !
2820 C302        !
2830 C302        !END OF LINE FOUND - SO PRINT IT
2840 C302        !
2850 C302 20BEC4             JSR PRTOUT
2860 C305 38                 SEC
2870 C306 B08A               BCS MAINLP
2880 C308        !
2890 C308        !
2900 C308        !NOT END OF LINE
2910 C308        !
2920 C308 AD05C0 NOTNUL      LDA QOTFLG
2930 C30B F003               BEQ QOTOFF
2940 C30D 4CA8C3             JMP QUOTON
2950 C310        !
2960 C310        !
2970 C310        !NOT A STRING, SO CHECK FOR TOKENS
2980 C310        !
2990 C310 B1FB   QOTOFF      LDA (TXTPTR),Y
3000 C312 48                 PHA
3010 C313 2980               AND #$80
3020 C315 F054               BEQ NOTTOK
3030 C317        !
3040 C317        !
3050 C317        !CHARACTER IS A KEYWORD TOKEN
3060 C317        !
3070 C317 68                 PLA
3080 C318 C9AA               CMP #$AA
3090 C31A B049               BCS OPRTOR
3100 C31C 48                 PHA
3110 C31D        !
3120 C31D        !
3130 C31D        !IF IT IS A 'FOR' THEN INDENT
```


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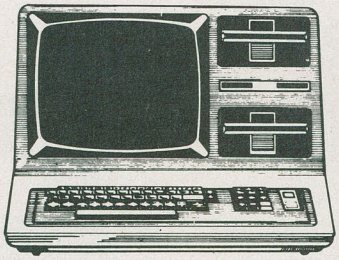

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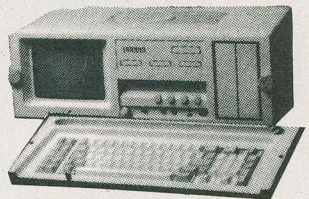

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Commodore List Debugger

```
3140 C31D          !
3150 C31D C981             CMP #$81
3160 C31F D00C             BNE CHKNXT
3170 C321 A904             LDA #$04
3180 C323 18               CLC
3190 C324 6D0CC0           ADC SPCNUM
3200 C327 8D0CC0           STA SPCNUM
3210 C32A 38               SEC
3220 C32B B01D             BCS PRTKEY
3230 C32D          !
3240 C32D          !
3250 C32D          !IF IT IS A 'NEXT' DON'T INDENT
3260 C32D          !
3270 C32D C982     CHKNXT  CMP #$82
3280 C32F D010             BNE CHKREM
3290 C331 AD0CC0           LDA SPCNUM
3300 C334 38               SEC
3310 C335 E904             SBC #$04
3320 C337 B002             BCS SETSPC
3330 C339 A900             LDA #$0
3340 C33B 8D0CC0 SETSPC    STA SPCNUM
3350 C33E 38               SEC
3360 C33F B009             BCS PRTKEY
3370 C341          !
3380 C341          !
3390 C341          !IF IT IS A 'REM' INCLUDE SPACES
3400 C341          !
3410 C341 C98F     CHKREM  CMP #$8F
3420 C343 D005             BNE PRTKEY
3430 C345 A9FF             LDA #$FF
3440 C347 8D07C0           STA REMFLG
3450 C34A          !
3460 C34A          !
3470 C34A          !PRINT THE KEYWORD AND SPACES
3480 C34A          !
3490 C34A AD06C0 PRTKEY    LDA COLFLG
3500 C34D D005             BNE COLFND
3510 C34F A920             LDA #$20
3520 C351 20AAC4           JSR PRINT
3530 C354 A900     COLFND  LDA #$0
3540 C356 8D06C0           STA COLFLG
3550 C359 68               PLA
3560 C35A 2051C4           JSR SRTTOK
3570 C35D A920             LDA #$20
3580 C35F 20AAC4           JSR PRINT
3590 C362 38               SEC
3600 C363 B098             BCS LINELP
3610 C365          !
3620 C365          !
3630 C365          !PRINT THE OPERATOR WITH NO SPACES
3640 C365          !
3650 C365 2051C4 OPRTOR    JSR SRTTOK
3660 C368 38               SEC
3670 C369 B092             BCS LINELP
3680 C36B          !
3690 C36B          !
3700 C36B          !CHARACTER FOUND IS NOT A TOKEN
3710 C36B          !
3720 C36B 68       NOTTOK  PLA
3730 C36C C920             CMP #$20
3740 C36E D00A             BNE NOTSPC
3750 C370 AD07C0           LDA REMFLG
3760 C373 F088             BEQ LINELP
3770 C375 A920             LDA #$20
3780 C377 38               SEC
3790 C378 B028             BCS PRTCHR
3800 C37A          !
3810 C37A          !
3820 C37A          !CHECK FOR A OPENING QUOTE
3830 C37A          !
3840 C37A C922     NOTSPC  CMP #$22
3850 C37C D00B             BNE TSTCOL
3860 C37E 20AAC4           JSR PRINT
3870 C381 A9FF             LDA #$FF
3880 C383 8D05C0           STA QOTFLG
3890 C386 4CFDC2           JMP LINELP
3900 C389          !
3910 C389          !
3920 C389          !CHECK FOR A COLON (STATEMENT END)
3930 C389          !
3940 C389 C93A     TSTCOL  CMP #$3A
3950 C38B D015             BNE PRTCHR
3960 C38D 20AAC4           JSR PRINT
3970 C390 AD07C0           LDA REMFLG
3980 C393 D00A             BNE COLEND
3990 C395 A920             LDA #$20
4000 C397 20AAC4           JSR PRINT
4010 C39A A9FF             LDA #$FF
4020 C39C 8D06C0           STA COLFLG
4030 C39F 4CFDC2 COLEND    JMP LINELP
4040 C3A2          !
4050 C3A2          !
4060 C3A2          !PRINT AN ORDINARY CHARACTER
4070 C3A2          !
4080 C3A2 20AAC4 PRTCHR    JSR PRINT
4090 C3A5 4CFDC2           JMP LINELP
4100 C3A8          !
4110 C3A8          !
4120 C3A8          !IN A STRING, CHECK FOR GRAPHICS
4130 C3A8          !OR CONTROL CHARACTERS
4140 C3A8          !
4150 C3A8 B1FB     QUOTON  LDA (TXTPTR),Y
4160 C3AA C922             CMP #$22
4170 C3AC D00B             BNE NOTQOT
4180 C3AE 20AAC4           JSR PRINT
4190 C3B1 A900             LDA #$0
4200 C3B3 8D05C0           STA QOTFLG
4210 C3B6 4CFDC2           JMP LINELP
4220 C3B9          !
4230 C3B9          !
4240 C3B9          !CHECK FOR A PRINTABLE CHARACTER
4250 C3B9          !
4260 C3B9 C921     NOTQOT  CMP #$21
4270 C3BB 900A             BCC CTLCOD
4280 C3BD C980             CMP #$80
4290 C3BF B006             BCS CTLCOD
4300 C3C1 20AAC4           JSR PRINT
4310 C3C4 4CFDC2           JMP LINELP
4320 C3C7          !
4330 C3C7          !
4340 C3C7          !POSSIBLE GRAPHICS/CONTROL CHAR
4350 C3C7          !
4360 C3C7 8D08C0 CTLCOD    STA CTLCHR
4370 C3CA A201             LDX #$01
4380 C3CC          !
4390 C3CC          !
4400 C3CC          !CHECK FOR MORE THAN ONE CHARACTER
4410 C3CC          !
4420 C3CC C8       NUMLP   INY
4430 C3CD B1FB             LDA (TXTPTR),Y
4440 C3CF CD08C0           CMP CTLCHR
4450 C3D2 D003             BNE SCHTAB
4460 C3D4 E8               INX
4470 C3D5 D0F5             BNE NUMLP
4480 C3D7 8E0BC0 SCHTAB    STX NUMCHR
4490 C3DA 88               DEY
4500 C3DB 98               TYA
4510 C3DC 48               PHA
4520 C3DD          !
4530 C3DD          !
4540 C3DD          !SEARCH CTLTAB FOR THIS CHARACTER
4550 C3DD          !
4560 C3DD A90E             LDA #<CTLTAB
4570 C3DF 85FD             STA TABPTR
4580 C3E1 A9C1             LDA #>CTLTAB
4590 C3E3 85FE             STA TABPTR+1
4600 C3E5 A000             LDY #$0
4610 C3E7 B1FD     CTLLP   LDA (TABPTR),Y
4620 C3E9 F053             BEQ NOTIN
4630 C3EB CD08C0           CMP CTLCHR
4640 C3EE F00F             BEQ CHRFND
4650 C3F0          !
4660 C3F0          !
4670 C3F0          !FIND THE NEXT TABLE ENTRY
4680 C3F0          !
4690 C3F0 2037C4 STEPON    JSR INCPTR
4700 C3F3 B1FD             LDA (TABPTR),Y
4710 C3F5 2980             AND #$80
4720 C3F7 F0F7             BEQ STEPON
4730 C3F9 2037C4           JSR INCPTR
4740 C3FC 38               SEC
4750 C3FD B0E8             BCS CTLLP
4760 C3FF          !
4770 C3FF          !
4780 C3FF          !CHARACTER IS IN THE TABLE
4790 C3FF          !
4800 C3FF 2037C4 CHRFND    JSR INCPTR
4810 C402 A95B             LDA #'[
4820 C404 20AAC4           JSR PRINT
4830 C407          !
4840 C407          !
4850 C407          !PRINT NUMBER OF CHARACTERS
4860 C407          !
4870 C407 AD0BC0           LDA NUMCHR
4880 C40A C901             CMP #$01
4890 C40C F00D             BEQ PRTCOD
4900 C40E 8563             STA FPA1+2
4910 C410 A900             LDA #$0
4920 C412 8562             STA FPA1+1
4930 C414 208EC4           JSR CVTNUM
4940 C417 AA               TAX
4950 C418 209EC4           JSR PRTNUM
4960 C41B          !
4970 C41B          !
4980 C41B          !PRINT THE C.T. CODE FROM CTLTAB
4990 C41B          !
5000 C41B A000     PRTCOD  LDY #$0
5010 C41D B1FD             LDA (TABPTR),Y
5020 C41F 2037C4           JSR INCPTR
5030 C422 48               PHA
5040 C423 297F             AND #$7F
5050 C425 20AAC4           JSR PRINT
5060 C428 68               PLA
5070 C429 2980             AND #$80
5080 C42B F0EE             BEQ PRTCOD
5090 C42D A95D             LDA #']
5100 C42F 20AAC4           JSR PRINT
5110 C432 68               PLA
5120 C433 A8               TAY
5130 C434 4CFDC2           JMP LINELP
5140 C437          !
5150 C437          !
5160 C437          !INCREMENT TABPTR
5170 C437          !
5180 C437 E6FD     INCPTR  INC TABPTR
5190 C439 D002             BNE INCEND
5200 C43B E6FE             INC TABPTR+1
5210 C43D 60       INCEND  RTS
5220 C43E          !
5230 C43E          !
5240 C43E          !CHARACTER IS NOT IN THE TABLE
5250 C43E          !
5260 C43E AE0BC0 NOTIN     LDX NUMCHR
5270 C441 AD08C0           LDA CTLCHR
5280 C444 48       NILOOP  PHA
5290 C445 20AAC4           JSR PRINT
5300 C448 68               PLA
5310 C449 CA               DEX
5320 C44A D0F8             BNE NILOOP
5330 C44C 68               PLA
5340 C44D A8               TAY
5350 C44E 4CFBC2           JMP LINELP
5360 C451          !
5370 C451          !
5380 C451          !EXPAND AND PRINT A BASIC TOKEN
5390 C451          !
5400 C451 AA       SRTTOK  TAX
5410 C452 98               TYA
5420 C453 48               PHA
5430 C454 8A               TXA
5440 C455          !
5450 C455          !
5460 C455          !IF IT IS PI THEN PRINT 'PI'
5470 C455          !
5480 C455 C9FF             CMP #$FF
5490 C457 D00D             BNE NOTPI
5500 C459 A950             LDA #'P
5510 C45B 20AAC4           JSR PRINT
5520 C45E A949             LDA #'I
5530 C460 20AAC4           JSR PRINT
5540 C463 68               PLA
5550 C464 A8               TAY
5560 C465 60               RTS
5570 C466          !
5580 C466          !
5590 C466          !NOT PI SO SEARCH RESERVED WORDS
5600 C466          !
5610 C466 38       NOTPI   SEC
5620 C467 E97F             SBC #$7F
5630 C469 AA               TAX
5640 C46A CA               DEX
5650 C46B          !
5660 C46B          !
5670 C46B          !FIND THE APPROPRIATE KEYWORD
5680 C46B          !
5690 C46B A000             LDY #$0
5700 C46D 2085C4 KWDLP1    JSR SCNWRD
5710 C470 CA               DEX
5720 C471 D0FA             BNE KWDLP1
5730 C473          !
5740 C473          !
5750 C473          !PRINT THE REQUIRED KEYWORD
5760 C473          !
5770 C473 B99EA0 KWDLP2    LDA RESWDS,Y
5780 C476 C8               INY
5790 C477 48               PHA
5800 C485          !
5810 C485          !
5820 C485          !FIND THE NEXT RESERVED WORDS
5830 C485          !TABLE ENTRY
5840 C485          !
5850 C485 B99EA0 SCNWRD    LDA RESWDS,Y
5860 C488 C8               INY
5870 C489 2980             AND #$80
5880 C48B F0F8             BEQ SCNWRD
5890 C48D 60               RTS
5900 C48E          !
5910 C48E          !
5920 C48E          !CONVERT A NUMBER IN FPA1 INTO
5930 C48E          !PRINTABLE CHARACTERS
5940 C48E          !
5950 C48E A290     CVTNUM  LDX #$90
5960 C490 38               SEC
5970 C491 2049BC           JSR PADOUT
5980 C494 20DFBD           JSR CVTSTG
5990 C497 2087B4           JSR GETSTG
6000 C49A 20A6B6           JSR DALSTG
6010 C49D 60               RTS
6020 C49E          !
6030 C49E          !
6040 C49E          !PRINT A NUMBER (FROM CVTSTG)
6050 C49E          !
6060 C49E A000     PRTNUM  LDY #$0
6070 C4A0 B122     CPYLP   LDA ($22),Y
6080 C4A2 20ARC4           JSR PRINT
6090 C4A5 C8               INY
6100 C4A6 CA               DEX
6110 C4A7 D0F7             BNE CPYLP
6120 C4A9 60               RTS
6130 C4AA          !
6140 C4AA          !
6150 C4AA          !STORE A BYTE IN THE PRINT BUFFER
6160 C4AA          !
6170 C4AA 8D08C0 PRINT     STA CTLCHR
6180 C4AD 98               TYA
6190 C4AE 48               PHA
6200 C4AF AC09C0           LDY BUFPTR
6210 C4B2 EE09C0           INC BUFPTR
6220 C4B5 AD08C0           LDA CTLCHR
6230 C4B8 990EC0           STA BUFFER,Y
6240 C4BB 68               PLA
6250 C4BC A8               TAY
6260 C4BD 60               RTS
6270 C4BE          !
6280 C4BE          !
6290 C4BE          !LINE FINISHED, SO PRINT BUFFER
6300 C4BE          !
6310 C4BE AC09C0 PRTOUT    LDY BUFPTR
6320 C4C1 A90D             LDA #$0D
6330 C4C3 990EC0           STA BUFFER,Y
6340 C4C6 AD0DC0           LDA WIDTH
6350 C4C9 8D0AC0           STA LINLEN
6360 C4CC          !
6370 C4CC          !
6380 C4CC          !FIRST SORT OUT THE LINE BREAKS
6390 C4CC          !
6400 C4CC A20F     LINEND  LDX #WORD
6410 C4CE AC0AC0           LDY LINLEN
6420 C4D1 B90FC0 SPCLP1    LDA BUFFER+1,Y
6430 C4D4 F004             BEQ PRTBUF
6440 C4D6 C90D             CMP #$0D
6450 C4D8 D003             BNE SPCLP2
6460 C4DA 4C5AC5 PRTBUF    JMP OUTPUT
6470 C4DD          !
6480 C4DD          !
6490 C4DD          !LOOK BACK FOR A SPACE CHARACTER
6500 C4DD          !
6510 C4DD B90EC0 SPCLP2    LDA BUFFER,Y
6520 C4E0 C920             CMP #$20
6530 C4E2 F010             BEQ SPCFND
6540 C4E4 C95B             CMP #'[
6550 C4E6 F008             BEQ BRKFND
6560 C4E8 88               DEY
6570 C4E9 CA               DEX
6580 C4EA D0F1             BNE SPCLP2
6590 C4EC          !
6600 C4EC          !
6610 C4EC          !NO SPACE FOUND AFTER 'WORD' BYTES
6620 C4EC          !
6630 C4EC AC0AC0           LDY LINLEN
6640 C4EF C8               INY
6650 C4F0          !
6660 C4F0          !
6670 C4F0          !OPEN BRACKET CHARACTER FOUND
6680 C4F0          !
6690 C4F0 A207     BRKFND  LDX #$07
6700 C4F2 D002             BNE MOVBYT
6710 C4F4          !
6720 C4F4          !
6730 C4F4          !SPACE CHARACTER FOUND
6740 C4F4          !
6750 C4F4 A206     SPCFND  LDX #$06
6760 C4F6          !
6770 C4F6          !
6780 C4F6          !CALCULATE GAP SIZE
6790 C4F6          !
6800 C4F6 18       MOVBYT  CLC
6810 C4F7 AD0CC0           LDA SPCNUM
6820 C4FA 690E             ADC #<BUFFER
6830 C4FC 85FD             STA BUFOFF
6840 C4FE A900             LDA #$0
6850 C500 690C             ADC #>BUFFER
6860 C502 85FE             STA BUFOFF+1
6870 C504 18               CLC
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6960 C505 8A                TXA
6970 C506 65FD              ADC BUFOFF
6980 C508 85FD              STA BUFOFF
6990 C50A A900              LDA #$0
7000 C50C 65FE              ADC BUFOFF+1
7010 C50E 85FE              STA BUFOFF+1
7020 C510 8C08C0            STY CTLCHR
7030 C513         !
7040 C513         !
7050 C513         !FIND END OF LINE IN BUFFER
7060 C513         !
7070 C513 A201              LDX #$01
7080 C515 C8                INY
7090 C516 B90EC0 LCLOOP     LDA BUFFER,Y
7100 C519 C90D              CMP #$0D
7110 C51B F005              BEQ ENDFND
7120 C51D C8                INY
7130 C51E E8                INX
7140 C51F 38                SEC
7150 C520 B0F4              BCS LCLOOP
7160 C522 8A      ENDFND    TXA
7170 C523 18                CLC
7180 C524 6D08C0            ADC CTLCHR
7190 C527 A8                TAY
7200 C528 E8                INX
7210 C529         !
7220 C529         !
7230 C529         !OPEN UP A GAP
7240 C529         !
7250 C529 B90EC0 MOVELP     LDA BUFFER,Y
7260 C52C 91FD              STA (BUFOFF),Y
7270 C52E 88                DEY
7280 C52F CA                DEX
7290 C530 D0F7              BNE MOVELP
7300 C532         !
7310 C532         !
7320 C532         !PUT C/R AND SPACES IN BUFFER
7330 C532         !
7340 C532 AC08C0            LDY CTLCHR
7350 C535 A90D              LDA #$0D
7360 C537 990EC0            STA BUFFER,Y
7370 C53A C8                INY
7380 C53B 18                CLC
7390 C53C AD0CC0            LDA SPCNUM
7400 C53F 6906              ADC #$06
7410 C541 AA                TAX
7420 C542 A920              LDA #$20
7430 C544 990EC0 FILLP      STA BUFFER,Y
7440 C547 C8                INY
7450 C548 CA                DEX
7460 C549 D0F9              BNE FILLP
7470 C54B         !
7480 C54B         !
7490 C54B         !UPDATE LINLEN FOR NEXT LINE
7500 C54B         !
7510 C54B 98                TYA
7520 C54C 38                SEC
7530 C54D ED0CC0            SBC SPCNUM
7540 C550 18                CLC
7550 C551 6D0DC0            ADC WIDTH
7560 C554 8D0AC0            STA LINLEN
7570 C557 4CCCC4            JMP LINEND
7580 C55A         !
7590 C55A         !
7600 C55A         !PRINTER ROUTINE (CENTRONICS)
7610 C55A         !FIRST INITIALISE THE USER PORT
7620 C55A         !
7630 C55A A200    OUTPUT    LDX #$00
7640 C55C 86FD              STX BUSY
7650 C55E 8E01DD            STX PORT
7660 C561 AD00DD            LDA PA2
7670 C564 0904              ORA #$04
7680 C566 8D00DD            STA PA2
7690 C569 A2FF              LDX #$FF
7700 C56B 8E03DD            STX DDR
7710 C56E AD02DD            LDA PA2DDR
7720 C571 0904              ORA #$04
7730 C573 8D02DD            STA PA2DDR
7740 C576 A000              LDY #$00
7750 C578         !
7760 C578         !
7770 C578         !NOW OUTPUT THE CHARACTER
7780 C578         !
7790 C578 B90EC0 OUTLP      LDA BUFFER,Y
7800 C57B F020              BEQ OUTEND
7810 C57D 8D01DD            STA PORT
7820 C580 AD00DD            LDA PA2
7830 C583 29FB              AND #$FB
7840 C585 8D00DD            STA PA2
7850 C588 A202              LDX #$02
7860 C58A CA      DELYLP    DEX
7870 C58B D0FD              BNE DELYLP
7880 C58D 0904              ORA #$04
7890 C58F 8D00DD            STA PA2
7900 C592 AD0DDD FLAGLP     LDA FLAG
7910 C595 2910              AND #$10
7920 C597 F0F9              BEQ FLAGLP
7930 C599 C8                INY
7940 C59A 38                SEC
7950 C59B B0DB              BCS OUTLP
7960 C59D 60      OUTEND    RTS
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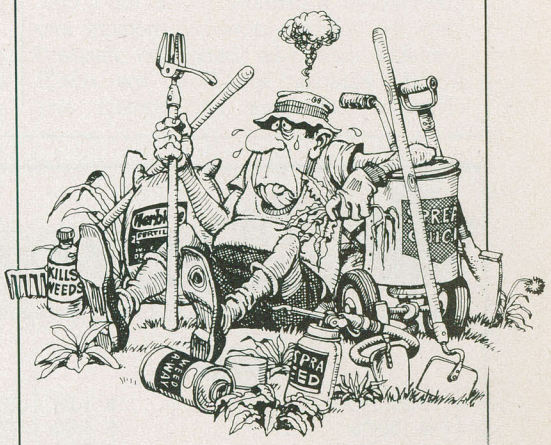

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Commodore List Debugger

Shoot the Printer

When you type LIST, the BASIC editor inside the ROM starts printing the BASIC program stored in memory. To do this it converts the numbers stored in memory into printable characters using the standard ASCII character set. Now, the ASCII character set does not contain any characters for cursor control, so the Commodore 64 prints graphics characters to indicate where cursor control characters exist.

This routine, then, converts these graphics characters to more intelligible symbols. All the graphics, control and cursor codes are be expanded into a standard format. The routine doesn't split words at the end of a physical line. That is, if there is insufficient space on the line for the next word, the routine generates a new line.

In addition to this, FOR NEXT loops are be indented for as many levels as is necessary. The line numbers are right justified on a five character field so that every line starts in the same place. All the keywords are preceded and followed by a single space, so that compacted lines get expanded. Likewise, colons used as statement separators are followed by a single space.

But wait... there's more. The maximum line width is adjustable without affecting any of the other features. Finally, the routine is capable of driving the standard Commodore printer or a Centronics printer connected to the user port.

The actual mythical creation that performs these wonders is a routine called COTEL. I actually wrote two very similar routines, one for the serial printer and one for a Centronics printer.

Inside Those Bytes

As I mentioned above, there are two similar routines, COTEL.SER and COTEL.CEN. Both are included here, but I will stick to describing the serial version. The important bits are the same anyway... it's only the printer drivers that vary.

In outline the routine works as follows.

Each physical line in the program is examined in turn until the end of the program is reached. As each line is scanned it is copied into an output buffer before being printed, including any extra spaces needed for FOR NEXT indentation and so on. Each keyword token is tested to see if it is either FOR or NEXT. If it is the appropriate number of spaces is added or subtracted from the current indentation.

Each character within a quoted string is tested to see if it is one of the graphic, control or cursor codes by comparing it with a table of these codes. If it is the appropriate standard code is written into the output buffer.

When the end of a line has been reached, the output buffer is scanned and carriage return characters and the appropriate number of spaces are inserted to accommodate the selected printer line width. Having been completely formatted the output buffer's contents are sent to the appropriate port to be printed.

When the output buffer has been completely printed it is cleared and the next program line is scanned. When the end of the program has been reached control is returned to BASIC. **CN!**

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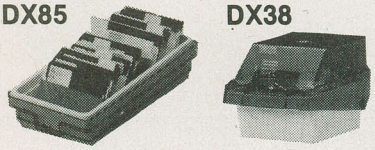

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Moorshead Publications — Almost Free Apple DOS Software

While CP/M is a wonderful thing in its own right, the Apple computer can also, and usually does, operate under DOS. For this reason, there's a multitude of programs available for it. Below, we offer a mini-multitude of our own.

The following programs will operate on any Apple][+, //e, //c, or true compatible operating under DOS 3.3. Apple users operating only under ProDOS may have to make alterations to some programs.

Almost Free Apple DOS Software #1

Picture Coder: All Apple HiRes pictures take up 36 sectors in their binary form. This program creates a textfile of a program in memory, squeezing out the zero bytes, that can later be EXECd into memory. The textfile often takes up less room on the disk.

DNA Tutorial: Operating under Integer BASIC, this program might appeal to 'clone' owners. In actuality, though, it's an interactive low-res graphics tutorial of DNA in its inherent forms. And you thought your Apple was only good for games...

Toad: Speaking of games, this program is an Applesoft BASIC implementation of 'Frogger' that can be controlled with either a joystick or the keyboard. The user's high scores are saved to disk.

Function Plotter: A fairly extensive Applesoft BASIC program that takes any inputted function and plots it on the HiRes Screen.

Data Disk Formatter: Apple DOS disks need not be bootable to be useful. This binary program formats a disk without setting DOS on the tracks, conserving useful disk space.

BASIC Trace: A program for the advanced Applesoft programmer, this file, when EXECd, displays the hexadecimal locations of each Applesoft line number of a program in memory.

Gemini Utility: A word processor pre-boot for Gemini printer users, this BASIC program initialises the printer's font or pitch before you boot your word processer.

Payments: This BASIC program allows you to keep track of payments and credits to and from up to 100 accounts on a single disk. A sample account is included.

Databox: A small but useful database program in Applesoft BASIC. Sample files are included to get you started.

Nullspace Invaders: A quick BASIC HiRes game testing coordination and judgement as you manipulate a monolith through mysterious gates.

Almost Free Apple DOS Software #2

Amort: A monthly amortization program that calculates monthly payments to an inputted figure, calculates principle, interest on every balance, and prints out the resulting chart.

Voiceprint: An unusual program that uses the HiRes screen to sample sounds inputted through the cassette jacks at the back of your Apple. Sampling rate and other variables can be controlled, and two sounds may be compared side-by-side.

Calc NOW!: Written in BASIC, this spreadsheet program is somewhat slower than VisiCalc, but still offers the power you expect from a spreadsheet. With sample files.

Cavern Crusader: A mix of BASIC and binary programming, winning this HiRes game is difficult, to say the least. For every wave of aliens shot in the cavern, there's always a meaner bunch in the wings.

Newcout: With source file. This binary program replaces the I/O hooks in the Apple with its own so you can operate your Apple through the HiRes screen. Comes with a character set.

Charset Editor: A utility to help you create your own character sets to use with Newcout.

Calendar: A BASIC utility useful for finding a particular day of any inputted month and year, or for printing out any given year.

LCLODR: With source. This binary utility BLOADs any given file into the 16K language card space at $D000. The source is useful in showing how to use DOS commands through assembly language.

Cristo Rey: An animated HiRes BASIC program showing Cristo Rey; by moonlight. For apartment-bound romantics.

ATOT: That's an acronym for 'Applesoft to Text'. EXEC this textfile to produce a textfile of your program.

Applesoft Deflator: This program takes a textfile made by ATOT and squeezes it, replacing PRINT statements with '?' and removing unnecessary spaces from the listing.

Almost Free Apple DOS Software #3

General Ledger: A fairly massive BASIC General Ledger program. This program creates a number of files, so it's best put on a separate disk before implemented.

EE-Design: A shape design aid program written in BASIC. Allows the user to plot shapes in HiRes and either save them to disk or print them out.

Quickzap: A disk sector utility that reads a given track and sector into memory and allows you to alter it, and optionally write it back to disk.

Softgraph: A complete graphing program written in both Applesoft and binary that enables you to see your data done up professionally in pie, line or bar charts.

IntelliCalc: An intelligent calculator with three memories and a 'paper tape' readout. Data may be inserted at any point.

Poker!: An Applesoft BASIC implementation of the game that has ruined many a marriage. Fortunately, you can afford to lose your electronic paycheque to you Apple... for now.

Polar Graphics: Similar in some ways to Function Plotter, this Applesoft program supplies a number of attractive functions in REM statements that you may utilize to plot out on the HiRes screen.

Clock and Clock II: Two Applesoft digital clocks. When your Apple's doing nothing better, it can now remind you of the time you're wasting. One has an alarm function.

Flowers: With source. A binary program that prints a border of flowers to the HiRes screen. The source is invaluable in showing how to handle HiRes shapes in assembly language.

Convert Utility: A BASIC program that converts numbers between decimal, hexadecimal, binary and disk sectors.

ProDOSfix.TXT: Apple clone users who've purchased ProDOS will note that it doesn't work on their machines. This text tutorial explains why, and how to remedy the problem.

Fine Print: The majority of this software has been obtained from on-line public access sources, and is therefore believed to be in the public domain. Any remaining programs were written in-house. The prices of the disks defer the cost of collecting the programs, debugging them, reproducing and mailing them, plus the cost of the media they're supplied on. The software itself is offered without charge.

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SOFTWARE NOW! has risen to the challenge. True to its name, this is the magazine that has now attempted the seemingly impossible: to pull together in one compact package everything you really need to know about the software market . . . Now!

The entire March issue of SOFTWARE NOW! has been dedicated to this single purpose: to catalog over one thousand of today's most popular . . . most IMPORTANT . . . software products. Ranging from Old Classics to products not even on the retailers' shelves at presstime, we have assembled a comprehensive listing of the products YOU need to know about . . . no matter what your micro hardware and operating system.

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The Software Survey forms the perfect complement to the in-depth assessments provided each month in SOFTWARE NOW! A Company supplement provides an invaluable who's-who of the software industry.

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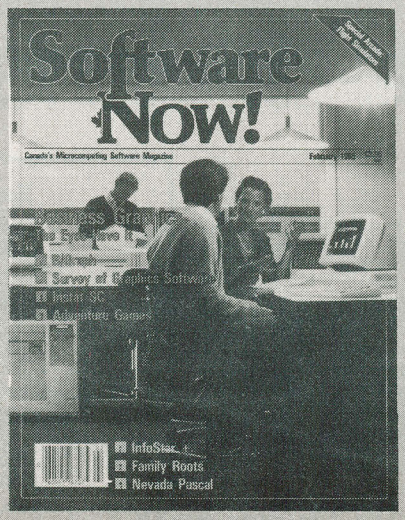

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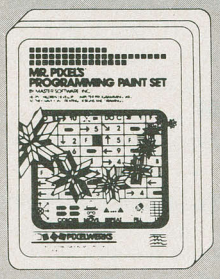

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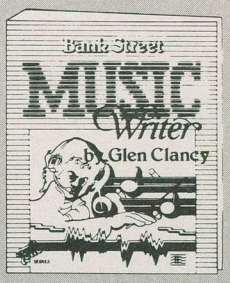

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continued from page 9

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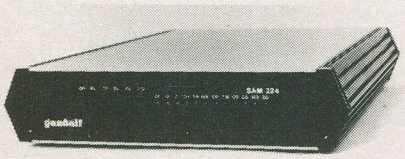

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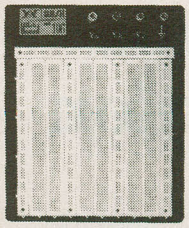

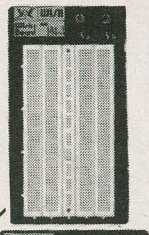

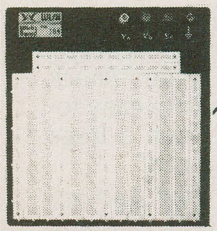

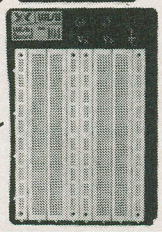

Solderless prototyping boards are the best way to quickly breadboard up a circuit. The holes are made especially for IC's, resistors, and other small parts with 22-28 gage wire leads, takes WW pins too.

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3 IC strips, 5 power strips
4 Binding posts, Aluminum plate
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2 Binding posts, aluminum plate.

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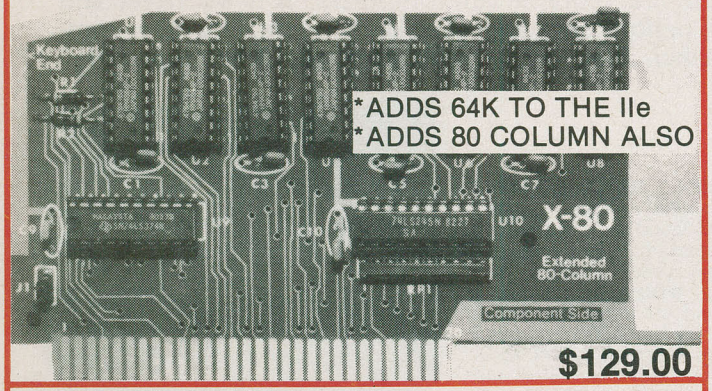

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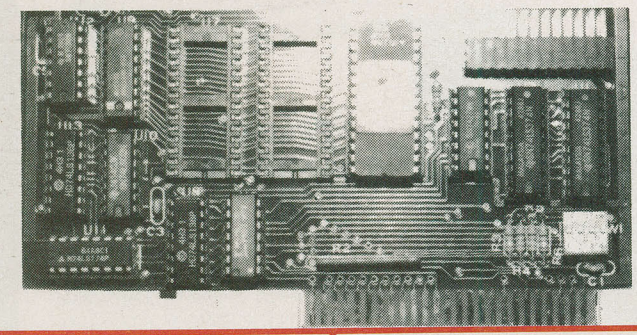

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DB-25 F IDC, Flat cable **$5.95**
DB-25 M Right angle PCB **$4.95**
DB-25 F Right angle PCB **$4.95**
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DB-15 F solder **$1.95**
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26 Pin 13 x 2 ..... **$2.50**
20 Pin 10 x 2 ..... **$2.00**
16 Pin 8 x 2 ..... **$1.50**
10 Pin 5 x 2 ..... **$1.00**

2 ROW RIGHT ANGLE HEADERS

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34 Pin RA 17 x 2 ..... **$3.00**
26 Pin RA 13 x 2 ..... **$2.50**
20 Pin RA 10 x 2 ..... **$2.00**
16 Pin RA 8 x 2 ..... **$1.50**
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Tin ..... **$4¢ per pin**

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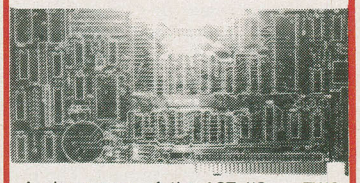
I/O + TWO



A clever copy of the AST I/O + TWO board with real time clock, game I/O calendar, and parallel and serial ports. A real good short card with assembly data **$24.95**

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* ONE MBE-XT 8 SLOT CPU BOARD
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* ONE IBM STYLE KEYBOARD
* ANY 4 BARE IBM PCB

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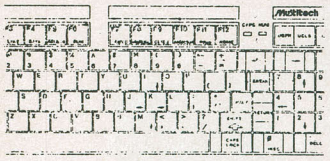

The excellent MARK-II Apple detached keyboard using serial cata (IBM) format. Plugs directly into Apple PCB

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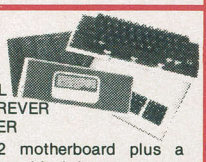

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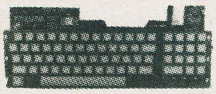

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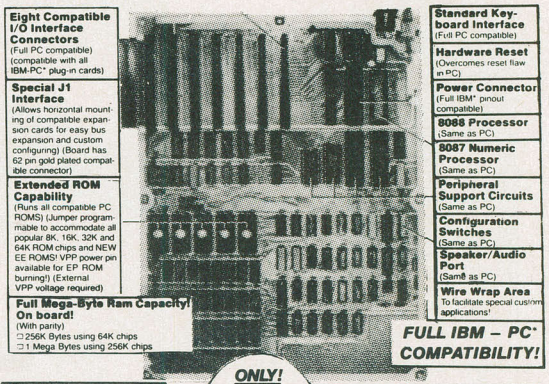

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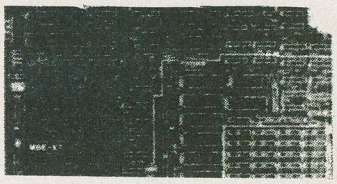

Here it is, a 256K XT compatible 8088 machine that works like an IBM. Note has 8 slots on 0.8" spacing to use modern XT peripherals, unlike the BEST which has only 5 on 1" spacing. The MBE-XT will hold any legal or illegal BIOS or BASIC. We suggest the MEGABIOS, one of the better ones available.

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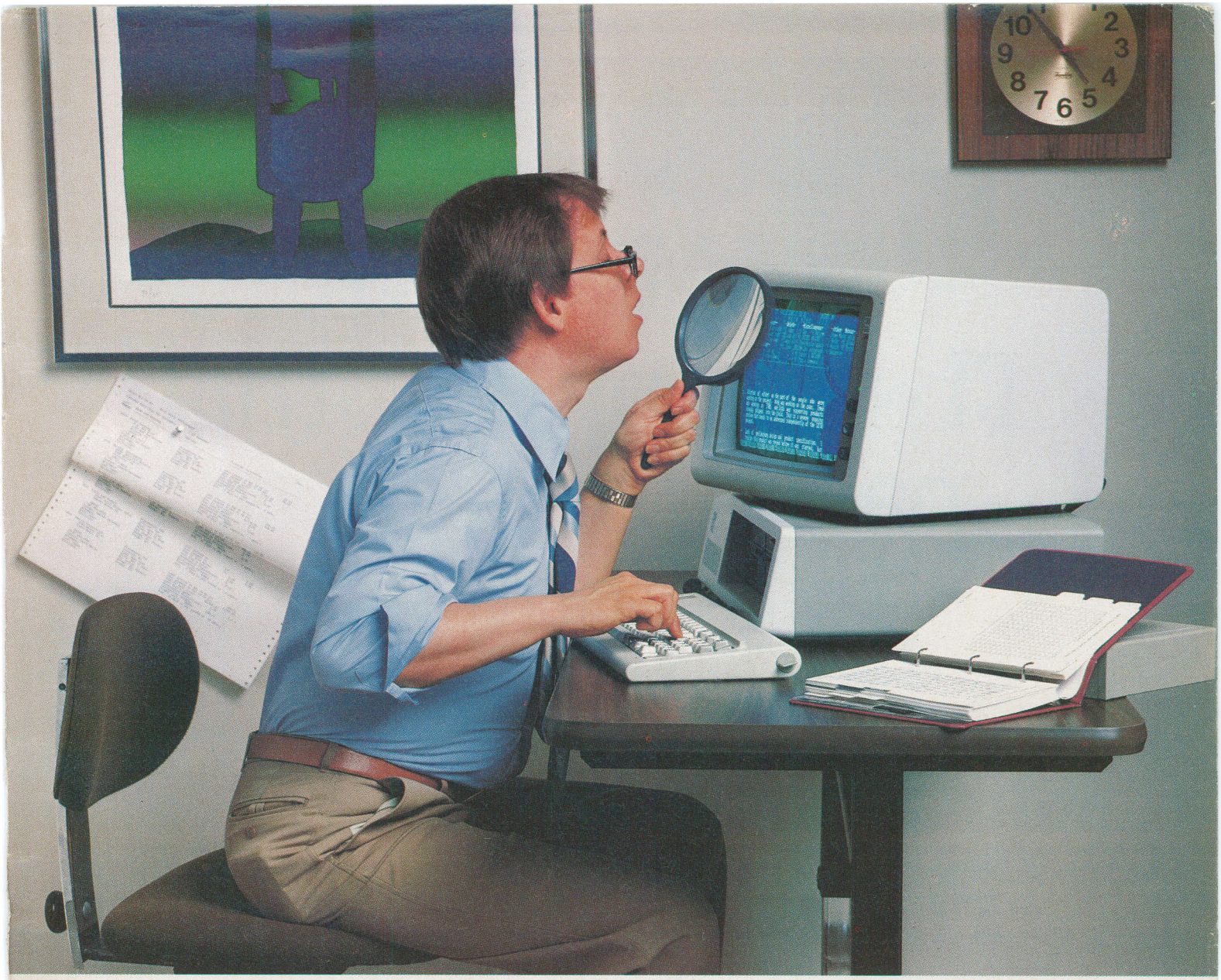

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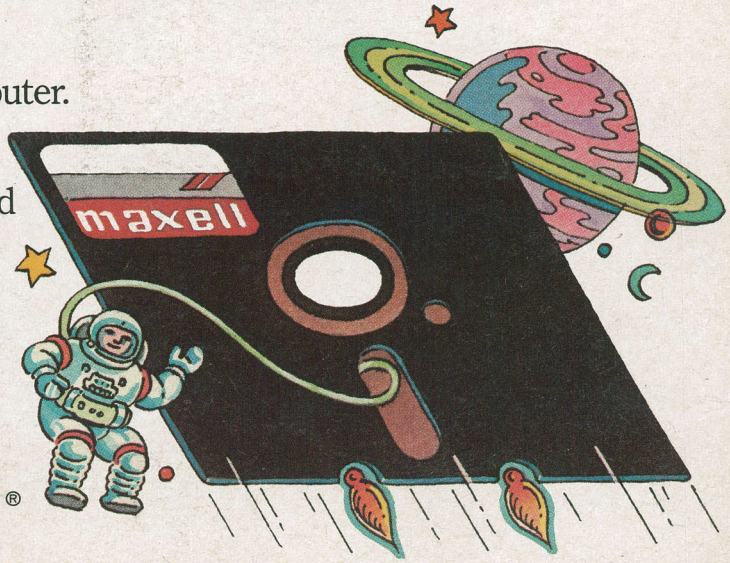

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